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ABSTRACT

This document is a description of an inquiry oriented, hands-on, kit-based science program initiated by the Pasadena Unified School District (PUSD) in collaboration with the California Institute of Technology in its culturally diverse urban school district. Descriptions include the PUSD science program setting, the major components of the program, teacher training or inservice, the role of the science professional and the science resource teacher, kit-based curriculum, ongoing professional development-assessment and pedagogy, and innovation value and impact. The curriculum section deals with PUSD science standards for K-12, kits for K-6 science, and the PUSD K-6 science curriculum. This document also includes copies of the Project SEED (Science for Early Educational Development) newsletter, expansions of the program, teacher professional development opportunities, and some of the details of the Pasadena Center plan. (JRH)

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ED 395 761

A Closer Look at Pasadena's K-6 Science Program

Science for Early Educational Development (SEED)

A collaborative effort

Pasadena Unified
School District
(P.U.S.D.)

California Institute
of Technology
(Caltech)

SE057955

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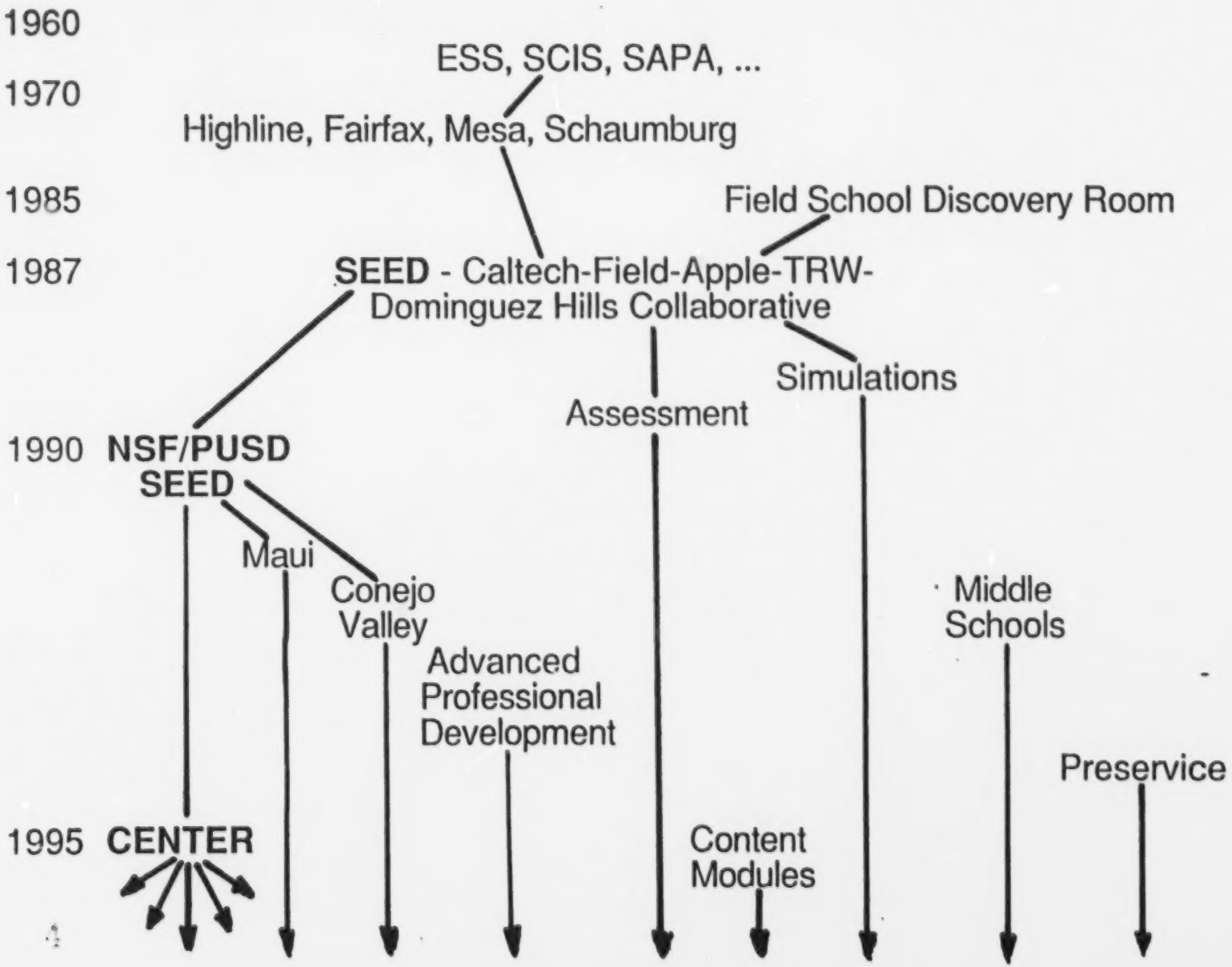
Program Overview

History of the Pasadena Science Program



The Pasadena Unified School District K-6 Science Program

Pasadena Unified School District (PUSD) in Collaboration with the California Institute of Technology (Caltech) initiated the monumental task of establishing an inquiry, hands-on, kit based science program in its culturally diverse urban school district. The program started eight years ago as a collaborative pilot program. In the fall of 1990, Project SEED, Science for Early Educational Development, as it was then called, was adopted by PUSD as its official elementary school science curriculum. As a result, P.U.S.D. SEED staff, in association with professional scientists at Caltech have now extended the program to all 525+ teachers and classrooms serving more than 12,500 children in the Pasadena School System K-6.

The districts previous textbook science program had been falling short of preparing its students for jobs in the technological world in which they live. This collaborative effort is one of the first in the nation to provide a model for science reform for other urban school districts using the scientific community as partners with the local public school district. The first goal of this program was to get all teachers teaching science. Once this happened a secondary goal was to establish a model of ongoing professional development in science that would go beyond the mechanical teaching and develop better teaching methods and ways of assessing students learning of science.

Decisions

Early on, 1985, a pilot school was established and teachers and scientists worked for five years to select, practice and revise already established science curriculum units that students would study. The same collaborative approach continued in establishing a training model for teachers with teachers, scientists and administration working together to see what was needed to support teachers in their effort to teach science differently. To support the districts effort to spread the program from one pilot school to all schools, a NSF proposal, "Hands-On science in Pasadena" was submitted in January of 1990, backed by a Board resolution.

The PUSD Science Program Setting

The K-12 Pasadena Unified School District encompassing 76 square miles and serving the communities of Pasadena Altadena, and Sierra Madre plus several adjacent unincorporated areas, has 30 schools and ancillary programs serving more than 22,500 students and 2,500 full and part time employees.

The district is funded primarily by the State of California at the rate of $3,1000 per student annually in general revenues, well below the national average, and has little discretionary authority to raise additional revenues. The total general fund budget for 1994-5 is approximately $4600 per student although additional funds are provided by various special federal and state programs to serve students with a wide variety of unique needs or educational problems.

Frequently thought of as the prosperous community shown on national TV each New Year's Day, the school district serves a far different population that is depicted. Once a much larger district with over 32,000 students in the 1960's, of whom the majority were White and middle to upper middle class in origin. The district's students population today is far more representative of the area's modern urban characteristics than its suburban past.

Over 43.2% of the students are Latino/ Hispanic and 35.2% are Afro American with less than 17.2% Anglo and 4.4% Asian. The rapid increase in the Latino population in the 1980's and 1990's is changing the demographic picture. This new population is a different one from that of the early 1970's in which "White Flight" followed court ordered integration in 1970. The Afro-American population has declined steadily since 1976 when it peaked at nearly 11,000 and has been displaced by the Latino influx following immigration patterns.

Over 12,000 students are from the two lowest income categories used by the U S Census and fewer than 5% were from the two top income groups. Over 10,000 students live with mother or father only in a step family or some form of court ordered or institutional setting and less than 50% live with both parents. Over 12,000 participated in federally supported "free or reduced meal" programs. Over 6,000 students are limited English proficient. More than 6,000 students are from families on "general relief".

This was the setting in which the Pasadena science reform was initiated and NSF supported. Our proposal was to establish a model for urban science reform in which a university and public school would collaborate to work from an early age to change the pattern of science teaching, thus Science for Early Educational Development, SEED, came into being.

The Major components of the program:

The PUSD Science Program (Science for Early Educational Development, formally Project S.E.E.D.) is an approach to teaching science by doing science rather than by reading and memorizing facts. In the process, students and teachers become familiar with the scientific method, gain valuable problem solving skills and develop an appreciation for the creative aspects of science. The vision of the program is to create and implement a method of early science education which will continue to raise the scientific knowledge and abilities of all our students. Although other hands-on inquiry-based science programs exist, our program is unique in the emphasis we place on the involvement of the scientific community in teacher training and teacher support.

Teacher Training or Inservice

One of the primary educational philosophies underlying the SEED model is that science instruction should and can be integrated with math, reading, writing, and the other subjects taught in the elementary school classroom. This can only happen, however, if science instruction is the responsibility of each regular classroom teacher and is not simply delegated to a science specialist. This, in turn, requires that regular teachers be provided with the opportunity to develop the confidence and skills necessary to teach experimental science.

In order to facilitate such a curriculum transformation, teacher science training is a central focus of the SEED program. Our training approach, however, is quite different from the usual emphasis on scientific facts, or on lectures centered on currently interesting scientific subjects. Instead our training programs focus on the scientific process itself as manifested by the curriculum materials teachers actually use in their classrooms. During first year training, teams of teachers work through

each hands-on science kit under the leadership of an experienced mentor teacher and a scientist. In this way the teachers become intimately familiar with the science materials before attempting to use them in the classroom.

Teachers learn all the activities the students will do during the units. After teachers have been introduced to each of the four units/ kits, they learn management activities and integration ideas to connect to other subjects. Finally, they teach the units in their own classrooms. A science (SEED) resource teacher plays a critical role as they visit the teachers in their rooms on a scheduled basis to assist in the lessons and give support to each teacher as they start to teach with an emphasis on inquiry science. Many ideas and management techniques are explored and tried sometimes for the first time. Teachers are supported and encouraged by regular professional development opportunities and gain the skills to support students as they engage in inquiry science activities.

The following summer teachers take part in the second year of inservice. During this time teachers return to the same small cluster of teachers (about ten) with the same lead teacher and scientist to review each of the four units they taught during the year. They discuss and replicate the activities/experiments. They adjust the activities/experiment where needed to facilitate good questioning techniques for the teachers to use with the students in their classrooms. It is during this inservice time that teachers start to look at the science they are introducing to their students. During the first year they are more concerned with the management of the materials and their own comfort level.

After teachers have taught the units at least twice at the same grade level they feel more confident in asking some of the really hard questions of themselves. For example, What am I teaching? What are the students learning? What is the purpose of the unit? Am I teaching effectively? How can I use the science journals more effectively? What science concepts and content are taught in the four units? Can these concepts be integrated with the other subjects so that students can make the connections to their own lives? These and other questions are now being explored in our ongoing professional development in science, for elementary school teachers.

The role of the Science Professional and the Science Resource Teacher

An important and novel aspect of our training program concerns the involvement of working scientists in the training teams. Rather than give lectures, scientists work side by side with teachers on the hands-on science materials in the kits, focusing their efforts on modeling the process involved in scientific reasoning and experimentation. When appropriate, the scientists also contribute to discussions on scientific content as well as the relevance of the particular hands-on science materials to contemporary scientific questions. In addition, the scientists are instrumental in stimulating teacher discussion regarding the purpose of the specific experiments they carry out in the kit. Perhaps most importantly, we encourage the science professionals to help the teachers feel comfortable and confident with their capability to teach hands-on science. We have found that teacher comfort and enthusiasm transfers directly to the interaction of the teachers with their own students.

Resource teachers follow up with classroom teachers giving them support with lessons, materials management, pedagogical techniques, and other classroom support. This ongoing support is a critical aspect for change in the teacher's role as facilitator. Sometimes the resource teacher helps in discussions, works with teachers and students on journal entries, and poses questions for further investigation or replication. Teachers enjoy the stimulation of participating in an innovative program, and of practicing a powerful style of teaching which is student-centered and based on cooperative learning. Resource teachers encourage teachers to learn along with their students. The students have the experience of doing real science and investigating real scientific phenomena. They record their observations and data in science journals from Kindergarten throughout the grades, learning to become accurate in their drawings and recording of data. Not only do they learn more working together, but they enjoy an increased sense of school involvement and develop better skills for social and intellectual interactions.

Kit-based curriculum

PUSD (SEED) has modified and enhanced a core program of hands-on science kits which have been successfully developed over the last 20 years

by educators and scientists. The kits sent to the classrooms are from the basic published units with modifications to meet the needs of Pasadena students. We include items such as primary source books, science journals for recording observations and collecting data, teachers suggestions, and assessments developed by our teachers and scientists working with researchers as well as extra materials for added students. Using these kits, first graders learn about plants by growing them and study the influence of the environment on plant development. Third graders build boats and study the effect of mass, volume, density, and materials on the boats' ability to float. Fifth graders learn the fundamentals of electricity by building circuits made with batteries and bulbs. The kits are, by their nature, excellent science teaching materials. Not only children, but adults, learn science better by doing it rather than by reading about it. In addition, the kits help the teacher to focus attention on teaching techniques which make the students successful experimenters, rather than on just teaching facts.

Students are encouraged to go beyond the designed experiment and research other questions they may have about science concepts they are studying. We are striving for inquiry in the overall program for both teachers and students. The journals are the written record of where the students are in the lessons as well as a record of what the student has or has not learned.

The kits are refurbished by the district quarterly so that each teacher starts the unit with all necessary materials. There are four units or kits to investigate during the year, one per grading period. Many of the units concepts, such as magnetism, are repeated in other grades. These building blocks help to construct the students own knowledge of the world around them.

Ongoing Professional Development-Assessment & Pedagogy

For the Pasadena Unified School District, this program represents a dramatic energizing influence on the school system. This program is continually growing and changing as we receive feedback from both the teachers and the students and as we find new ways to support the final goal of teaching elementary students critical thinking skills. We have worked with Dr. Richard Shavelson from the Graduate School of Education

at U.C. Santa Barbara as well as Dr. Gail Baxter from the University of Michigan to integrate assessment tools into the kits which will measure the effectiveness of the program in educating the students in science.

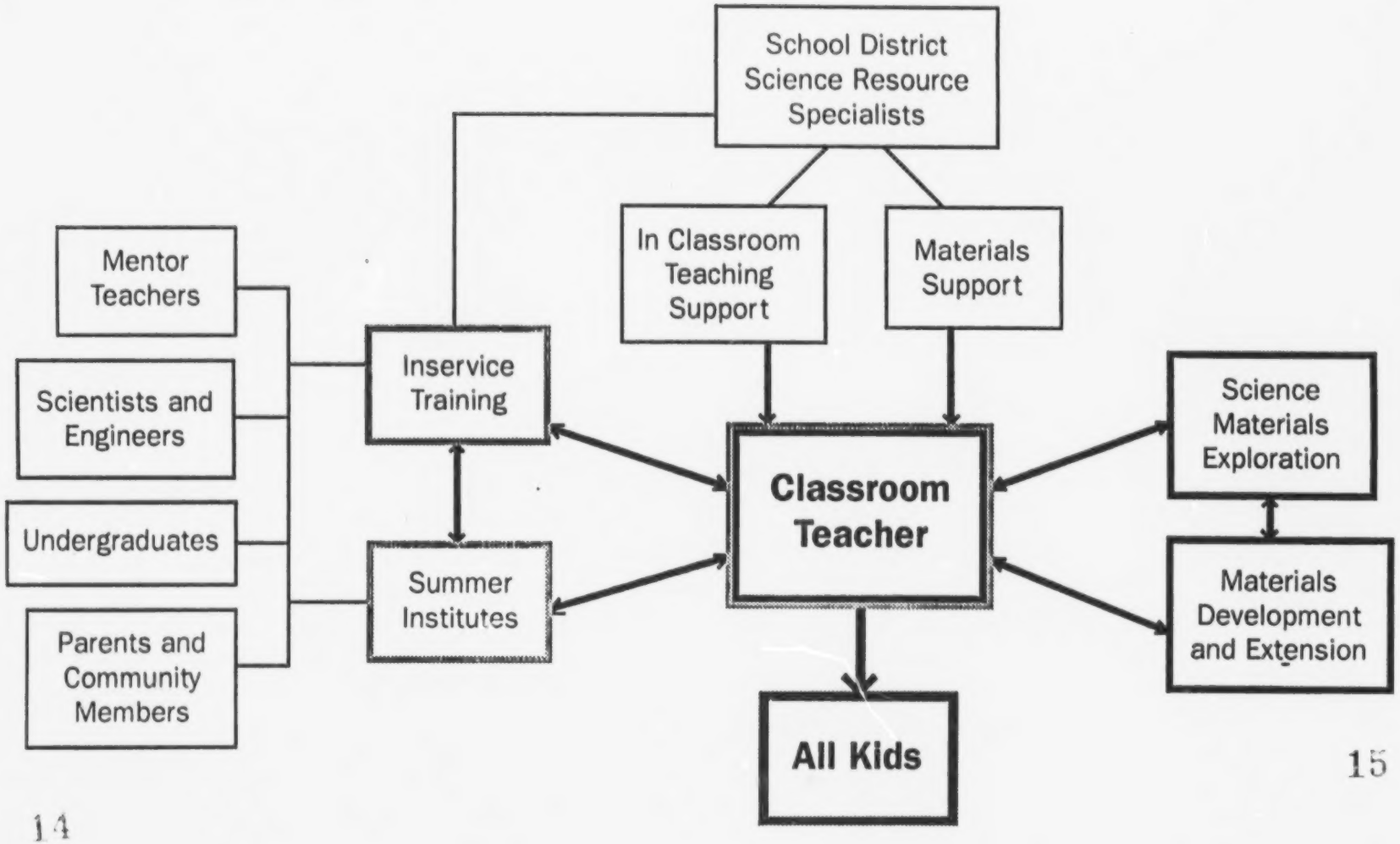
Teachers have joined teams with scientists and resource teachers and researchers to create assessments to measure students learning. In addition to these controlled assessment tools, we use regular classroom visitations as another method to ensure the quality of the program. While discussing with the students their experiments we attempt to determine to what degree their experience with science increases their level of awareness of the world, develops their observation skills and improves their analytical problem solving skills. In general it is fair to say that an elementary school child who has the benefit of participating in the PUSD science (SEED) curriculum will have experiences and science knowledge beyond that of the majority of students who have only experienced a textbook approach. However, we still consider our efforts as work in progress.

Conclusion for Innovation Value and Impact

The California Science Framework and National Standards are much better matched to such a curriculum than to fact-based textbooks. The Pasadena Program can provide the state with a benchmark for implementing the new science framework. For the students, the potential rewards are great. In addition to the intellectual rewards, the doing of inquiry based hands-on science usually involves working in groups and the cooperative learning experience is essential for many students. After a rewarding early exposure to science, many students, who would not have done so previously, will continue science studies in middle school and high school. For some this will be the key to technology-based jobs, for others it will open up a lifelong intellectual involvement with science.

Many districts across the nation have moved toward hands-on science. Although there is a wealth of good kit based curricular material, at the elementary level, there are currently no well-established blueprints for high quality experiences for the professional development of teachers. We have demonstrated how science professionals can play an important role in improving the level of scientific knowledge of our nation. Furthermore, in the process of teaching students science, we have

established a model demonstrating a district level strategy for serving underachieving students; empowering alternative learning strategies; building leadership in the total school setting; and developing interdisciplinary programs.


School District Science Resource Specialists
In Classroom Teaching Support
Materials Support
Mentor Teachers
Scientists and Engineers
Undergraduates
Parents and Community Members
Inservice Training
Summer Institutes
Classroom Teacher
Science Materials Exploration
Materials Development and Extension
All Kids

Curriculum

Pasadena Unified School District

Elementary Science Program Units

Grade Level	Life Science	Earth Science	Physical Science
K	Beginning Senses Being Me Pond & Aquarium	← Sunlight & Shadows →	
1	Senses Frog & Tadpole Growing Seeds		
	← Pollution & Ecology →		
2	Butterflies & Moths	Weather	Magnets Changes
3	Brine Shrimp		Clay Boats Structures
		← Scientific Reasoning →	
4	Mealworms Action/Reaction	Rocks & Charts The Environment & Its Pollution	Small Things
5	Crayfish	Daytime Astronomy	Batteries & Bulbs Mystery Powders
6	Fast Plants Human Body Systems	There is No Away	Magnets & Motors
7			
8			

Meeting the Standards for 2000

As a result of the elementary program and meetings with teachers, administrators and scientists in the community Yure´ summarized the national science standards applicable to all students in Pasadena. This has become the skeletal outline for the curriculum development in science from kindergarten through twelfth grade. Now that all elementary teachers are now inserviced to teach the four units at their grade level we have begun to look beyond the initial units and are working with teachers and scientist to reevaluate each unit and add more so teachers will have more choice. (See Pasadena Unified School District Science Program Units)

PUSD Science Standards, K-12.

All students must have the opportunity to learn science as defined in the national standards:

* With appropriate opportunities and experiences, all students can learn this science;
* Students should learn science in ways that reflect the inquiry used by scientists to understand the natural world;
* Learning is an active process that occurs best when each student acts as a member of a learning community;
* The quantity of factual knowledge and routine skill must be limited to what is essential so that students have the time to attain deep understanding and the thinking power defined in the content standards; and,
* Content, teaching, and assessment standards guide the central features of the educational program.

Teachers of science guide and facilitate science learning. To do this they:

* interact with their students as the students pursue their inquiries,
* orchestrate the discourse about scientific ideas amongst students,
* recognize student diversity and ensure that all students participate fully in science learning,
* challenge students to take responsibility for their own work and also to work collaboratively , and
* encourage through self- example the habits of minds, curiosity, excitement, and creativity of scientists.

Teachers of science design and manage a learning environment that provides students with the time, space, materials, equipment and resources needed for learning science. They:

* structure the time available so that students are able to engage in extended investigations and in-depth inquiry,
* provide a setting for student work which is flexible and supportive of science inquiry,
* provide students with access to the tools and materials they need for hands on investigation,
* ensure a safe working environment,
* make available print and media resources, identify and use resources outside the school , and
* engage students in the design process

Science Content includes four specific categories :

* Science as inquiry
* Science subject matter
* Scientific connections
* Science and Human Affairs

It is important to recognize what these categories represent and equally importantly what they do not represent. They serve to organize and group overlapping and mutually dependent clusters of student learning.

Science as inquiry should be recognized as a basic and controlling principle in the ultimate organization and experiences in students' science education. It serves four essential functions:

* To assist in the development of student understanding of scientific concepts;
* to help students "know how we know" in science;
* to develop an understanding of the nature of scientific inquiry;
* to develop the skills necessary to become independent inquirers about the natural world and to develop the inclination to use them.

When students engage in inquiry, they use a wide range of tools and skills, make choices among alternatives, and determine what factors are important.

As a result of inquiry-oriented activities in grades K-5, all students should develop the ability to:

* ask for information to use in answering a question,
* plan and conduct a simple investigation,

* employ simple equipment to gather data and extend the senses,
* use data and experiences to construct a reasonable explanation, and
* communicate about investigations and explanation.

As a result of inquiry-oriented activities in grades 6-8, all students should develop the ability to:

* identify appropriate questions for a scientific investigation,
* design and conduct a scientific investigation,
* use appropriate tools and technologies to gather, analyze and interpret data,
* construct explanations and models using evidence,
* think critically and logically about the relationships between evidence and explanations,
* recognize and analyze alternative explanations and procedures, and
* communicate scientific procedures and explanations.

As a result of inquiry-oriented activities in grades 9-12, all students should develop the ability to:

* identify the questions and concepts that guide scientific investigations,
* design and conduct a full scientific investigation,
* use technologies to improve investigations and communications,
* construct and revise scientific explanations and models using logic and evidence,
* recognize and analyze alternative explanations and models, and
* communicate and defend a scientific argument, and
* analyze a historical or contemporary scientific inquiry.

Physical Science

As a result of activities in grades K-5 all students should develop an understanding of:

* properties of objects and materials,
* position and motion of objects and
* forms of energy: heat, light, electricity and magnetism

As a result of activities in grades 6-8 all students should develop an understanding of:

* properties of matter
* particulate model of matter,
* motions and changes in motions, and

* transformations of energy.

As a result of activities in grades 9-12 all students should develop an understanding of:

* structure of matter
* chemical interactions,
* forces and motion, and
* conservation and transmission of energy

Life Science

As a result of activities in grades K-5 all students should develop an understanding of:

* characteristics of organisms,
* life cycles of organisms,
* organisms and environments, and
* cells.

As a result of activities in grades 6-8 all students should develop an understanding of:

* structure and function in living systems,
* reproduction, heredity, and variation,
* diversity and adaptations of organisms, and
* populations and interdependence.

As a result of activities in grades 9-12 all students should develop an understanding of:

* the diversity of organisms,
* cell function,
* heredity,
* matter, energy, and organization of living systems,
* evolution of living systems, and
* populations and interdependence.

Earth and Space Science

As a result of activities in grades K-5 all students should develop an understanding of:

* properties of Earth materials, and
* objects in the sky

As a result of activities in grades 6-8 all students should develop an understanding of:

* interactions and cycles in Earth systems,
* Earth history, and ,
* Earth in the Solar System.

As a result of activities in grades 9-12 all students should develop an understanding of:

* matter and energy in Earth systems,
* biogeochemical processes and cycles in Earth systems, and
* the Earth in the universe

Science and Technology

(This standard establishes useful connections between the natural world and the designed world and offers essential decision-making abilities)

As a result of activities in grades K-5 all students should develop an understanding of:

* ways to state a problem
* ways to design and implement a solution,
* ways to evaluate the solution, and
* ways to communicate the problem, design, and solution

As a result of activities in grades 6-8 all students should develop an understanding of:

* process of technological design,
* connections between science and technology, and
* similarities and differences between scientific inquiry and technological design.

As a result of activities in grades 9-12 all students should develop an understanding of:

* the nature of technology,
* the process of technological design,
* interactions between science and technology, and
* similarities and differences between science and technology.

Kits for K-6 Science

There are a wealth of kit-based K-6 materials, many of them described in a book from the National Science Resources Center (NSRC) called *Science for Children: Resources for Teachers*. This is available from the National Academy Press, NSTA, or Carolina Biological Supply Co. The NSRC was founded by the National Academy of Sciences and the Smithsonian Institution, to help improve K-12 science education. They are at:

Smithsonian, Arts and Industries
Washington, D. C. 20560
Telephone: 202-287-2063

When we began our project in Pasadena, in 1986, the NSRC book was not available, and we depended on consultations with the leaders of the few districts with exemplary hands-on science curricula. We adopted 24 kits from the Mesa Arizona Schools, which had been developed mainly from ESS kits of the 60's. The pages following describe our present curriculum, based on 28 kits, which have evolved from this starting set. Some have become "our own", and others (about 1/3) are from a new group of commercially available kits described below.

We believe that the task of creating from scratch a well-crafted kit-based unit, which is pedagogically and scientifically sound, and teacher-friendly, is not a sensible use of school or district resources. It is a very big, and sophisticated, challenge. In the past few years, three excellent new kit-based programs have provided units distinguished by their pedagogical quality and teacher-friendliness. They were developed with large grants from NSF and others, thoroughly field-tested, and so on. In our view, units picked from these will provide any school or district with a good starting point. It is then highly desirable to take ownership by modifying the original units based on teaching experience, to match the desires of local teachers and students.

Each set of units has some common stylistic characteristics which distiguish it from the others. However, within each set there is a good deal of variation, because different development teams produced different units. Free brochures are available, but without looking at teachers' guides it will be impossible to know what any specific unit is really like. These cost from 25 to 50 dollars. It is possible that all the teachers' guides can be seen in the NSRC library in Washington, but that needs to be checked. Class-sized kits, for approximately 30 students, cost on average $300.00, of which most goes for reusable equipment.

The names of the sets of units, and the sources of supply are:

1. Insights. Developed by Educational Development Corporation, published by:

   Optical Data Corporation
   1-800-524-2481 (Eastern Time)

2. Science and Technology for Children, STC. Developed by NSRC, published by:

   Carolina Biological
   1-800-334-5551 (Eastern Time)

3. Full Option Science System, FOSS. Developed by Lawrence Hall of Science, published by:

   Encyclopedia Brittanica
   1-800-554-9862 (Central Time)

Pasadena Unified School District
K-6 Science Curriculum

Kindergarten

(A) Beginning Senses:
This unit consists of hands-on activities which give students experience in using the senses of tasting, touching, hearing, seeing, and smelling. The students learn to name the five senses and the body parts associated with each sense. The emphasis of this kit is to increase the students awareness of the world around him/her and help him/her realize that we use our senses to examine our surroundings.

(B) Myself and Others:
Children at this age are quite egocentric and in this unit they are encouraged to become more aware of others. Children are naturally curious about how they fit into the human and physical environment around them. This unit introduces students to similarities and differences among people. It gives an overview of how children feel about themselves, and how their identity to their world influences their desire to learn. There is a strong link between discovery and self-esteem.

(C) Pond and Aquarium Life:
Pond and Aquarium is the Kindergarten live unit in project SEED. In this unit students will become familiar with the three different animals (fish, snail, newt) and three different plants (cuba, anacarus, and sword) which they observe over a six to eight week period. They learn the basic parts of water plants and the similarities and differences of the three water animals. They also observe a natural habitat of water plants and animals in a pond or a stream.

(D) Sunlight and Shadows:
Sunlight and Shadows is the Kindergarten physical science. In this unit students become familiar with the movement of the sun during the school day. They will observe their own shadows and the shadows of other objects. They will discover how the shadows change during the course of a day. Using flashlights in the room, they will experiment with their shadows and with the shadows of other objects. They will learn what makes a shadow and how they can make more than one shadow. This unit introduces children to some of the more common characteristics of light and shadows. The students investigate the properties of both natural and artificial light and shadows as they study the sun, earth, moon, and their shadows.

Sources of the Project SEED kits:

(A) Beginning Senses:	our own, similar to "Ourselves, Stages 1 and 2" from The Teacher's Laboratory, Inc.
(B) Myself and Others:	EDC Insights
(C) Pond and Aquarium Life:	our own, modified from Delta's "Observing an Aquarium" and "Pond Life"
(D) Sunlight and Shadows:	our own, similar to Delta's "Sunshine and Shadows"

First Grade

(A) Growing Seeds:
This unit provides the student with real and meaningful experiences concerning plant growth. Through the activities, the student learns about the characteristics and behavior of seeds, the life cycles of plants, and the identification of plant parts and growth patterns. Graphing skills are developed.

(B) Senses:
This unit utilizes hands-on activities which give students experiences in using the senses of touching, tasting, hearing, seeing, and smelling. Students learn to identify the body parts associated with each sense, and they learn how that sense helps them interact with their environment.

(C) Frogs and Tadpoles:
Frog and Tadpole is the 1st Grade live unit in project SEED. In this unit students will become familiar with the growth of the egg to tadpole and then to frog. They observe the complete process of metamorphosis and discuss the different stages as the tadpole develops into a frog. By doing this unit, students learn to work in cooperative groups and also to record their observations.

(D) Pollution and Ecology:
In this unit students learn the definition of ecology: the study of living things in their natural surroundings, or environment. This unit introduces students to the pollution surrounding them and how this pollution affects their senses. They will develop an awareness of the level of pollution by doing experiments to measure the amount of pollutants in the air, water, and land. They will also be introduced to the concept of noise pollution. Through direct observation, they gain a better understanding of the effects of pollution on the environment.

Sources of the Project SEED kits:

(A) Growing Seeds:	ESS manual, Delta cards
(B) Senses:	EDC Insights
(C) Frogs and Tadpoles:	ESS
(D) Pollution and Ecology:	our own

Second Grade

(A) Magnets:
The purpose of this unit is to give students hands-on experiences which allow them to explore the properties and uses of magnets. They become familiar with the properties of magnets by testing the strength of different magnets. They also test to determine which materials are attracted by the magnets and which are not and more specifically which metals are attracted and which are not. They also test to see whether magnets will attract through different thickness of paper, wood, plastic, and air. They become familiar with the differences found at the ends (or poles) of the magnets and how magnets can be used to magnetize other items. They end the unit by making their own electromagnet.

(B) Weather:
Students will use the weather unit as a focus to observe, measure and record weather changes. The students become familiar with the different elements which help determine our weather. This unit introduces students to the use of a thermometer and they learn how to make their own thermometers. They measure water temperature, temperature in the shade verses in the sun, and the temperature of soil with and without water. They explore the nature of wind, humidity, evaporation , and precipitation. They learn about different cloud types and how to make a rainbow.

(C) Butterflies and Moths:
This unit allows students to observe, predict, classify, and record the life cycle of the butterfly and moth. The body parts of the larvae and butterfly are difficult to see, and an emphasis is placed on using hand magnifiers to observe details

(D) Changes:
This unit was written for the purpose of aiding students' understanding of the change process. In this unit students will become familiar with the changes that take place in their own lives, in themselves, and in the people around them. They will also explore changes in nature: temperature changes throughout the day, changes in plants as they grow from a seed and chemical changes which they create with their own experiments.

Sources of the Project SEED kits:

(A) Magnets:	Mesa, AZ's manual and Highline, WA's manual mixed and modified
(B) Weather:	our own, similar to Delta's "Weather Watching"
(C) Butterflies and Moths:	our own, similar to ESS and Delta kits
(D) Changes:	our own, modified from Mesa, AZ's manual, and EDC Insights

Third Grade

(A) Clay boats:
Children's ideas about buoyancy and displacement are likely to be based on their own play in the bathtub or a swimming pool. The activities described in this unit offer the student a chance to explore and test their ideas. They work with objects of different shapes, sizes, and densities. This unit provides experiences with solids and liquids and can provide the beginning of a useful understanding of the density of materials. The students investigate the possibilities of making a small lump of clay float in a container of water. As work progresses, they make clay shapes and fill them with various "cargo" discovering which boats hold the most cargo. Through this process students discover Archimedes' principle for themselves.

(B) Structures:
The students study the properties of materials and design configurations of different structures while building their own structures. This unit uses flexible materials so that the students can explore the properties of different materials and of different approaches to designing building. The students attempt to make the tallest building and the most stable building using different types of materials.

(C) Brine Shrimp:
Brine Shrimp is the 3rd grade live science unit in project SEED. In this unit students will become familiar with the life cycles of the brine shrimp. They will make comparisons and record the data as they observe the changes that take place in their growth. They will learn to design their own experiments to test conditions which may affect the viability of the brine shrimp.

(D) Scientific Reasoning:
This unit starts students thinking about variables. It helps them to recognize the difference between variables that affect an outcome and variables that do not. There are several investigations using pendulums where students attempt to discover which is the important variable in determining how many swings a given pendulum has in a specified amount of time. Students use stethoscopes to measure their heart rate after different activities. They use helicopters to determine which variables may affect their flight. This unit encourages students to observe, investigate, make predictions and then verify the accuracy of their predictions by observing the results.

Sources of the Project SEED kits:

(A) Clayboats:	ESS
(B) Structures:	our own modified from EDC Insights and ESS mixed together
(C) Brine Shrimp:	ESS
(D) Scientific Reasoning:	our own based on Lawrence Hall of Science's manual and "Pendulums" by ESS

Fourth Grade

(A) The Environment & Its Pollution:
The lessons in this kit are designed to interface with the Armory for the Arts program: Children Investigate the Environment. The lessons begin with explorations of the properties of: water, air, soil, and sound. Once the students are familiar with these properties, they perform experiments which help them understand how of our environment becomes polluted, as well as ways to prevent the pollution.

(B) Rocks and Charts:
Rocks are among the things children like to collect best. This unit takes advantage of this interest and offers ways for students to look closely at the characteristics of rocks and establish ways of comparing and classifying them. Students learn how to set up experiments to determine hardness and softness of rocks, as well as other properties, and chart their results. In this unit students are introduced to the general process of classification and how scientists use generalizing principles to create groups.

(C) Behavior of Mealworms:
Meal worms is the fourth grade live unit in project SEED. By the time the students begin their studies of meal worms they should have been exposed to other live units which emphasize observational studies: Brine shrimp, Butterflies & Moths, Frogs & Tadpoles, and Pond & Aquarium. The fourth and fifth grade live units in project SEED encourage the students to go beyond observation to experimentation. The fourth and fifth grade live units are designed to introduce students to the difficulties which behavioral biologists encounter in attempting to control variables while working with a living experimental system.

(D) Small Things:
In this unit students will become familiar with the use of microscopes and have items they have never seen before become real for them. They will also see how the use of stains can make certain parts of cells become more distinct. In addition, the student will experience first hand how instruments can be used to extend our senses. The microscope provides the student with an instrument which extends the sense of sight in a radical manner.

Sources of the Project SEED kits:

(A) The Environment and Its Pollution	our own by PUSD teachers
(B) Rocks and Charts:	ESS manual, Delta cards
(C) Behavior of Mealworms:	ESS manual, Delta cards
(D) Small Things:	ESS

Fifth Grade

(A) Mystery Powders:
Students experiment with five mystery powders and learn to carefully examine them using their senses. The powders under investigation look similar, so students learn to do experiments to test the properties of the powders in order to determine how they differ. They record their experimental results and make inferences and predictions from their results.

(B) Batteries and Bulbs:
Batteries and Bulbs is an introduction to the study of electricity and magnetism. In the course of this study, students carry out experiments with their own simple equipment: flashlight batteries, small bulbs, various kinds of wire, magnets, and a compass. They determine how to make a bulb light, and they examine the inside of a light bulb in order to determine why and how the light bulb works. They examine different materials to determine which conduct electricity and which do not. They examine the difference between parallel and series circuits. The students make their own brightness meter, their own fuse and their own switches.

(C) Crayfish:
In this unit, students ask questions about the life of the crayfish. They learn to rely on what they see with their own eyes and feel with their own hands. They find that many of their questions can be answered by observing and doing simple experiments. Students have a better understanding of how scientists set up experiments to test their hypotheses as they explore different questions such as What do Crayfish eat? How do they eat? Which Crayfish is the strongest?

(D) Daytime Astronomy:
This unit starts where the students are--standing outside in the sunlight in their own city or town, on Earth. Students learn to observe and record shadows, and the resulting records of the sun's shadow tell us where the sun has been during the course of a day, a week, or a year. Students study the phases of the moon and the shadows cast from the sun. These records help to formulate and revise their mental model of the universe.

Sources of the Project SEED kits:

(A) Mystery Powders:	our own, modified from EDC Insights, ESS, Delta cards
(B) Batteries and Bulbs:	our own, modified from EDC's "Circuits and Pathways"
(C) Crayfish:	our own, modified from an ESS manual which is no longer available
(D) Daytime Astronomy:	our own, modified from an ESS manual which is no longer available

Sixth Grade

(A) Magnets and Motors:
Magnets and Motors is a unit about magnetism and electricity which has been designed to mirror the historical development of our understanding and use of magnetism, electricity, and electromagnetism. The unit progresses through these phenomena in the same order that people first learned about them - magnets and compasses, electricity from batteries, then electromagnetism (electromagnets, motors, and generators). The unit builds from understanding the use of magnets to the point that the students construct their own motor and generator.

(B) Experimenting with Plants:
Experimenting with Plants features the rapid cycling Wisconsin Fast Plant, which goes from seed to seed in about 40 days. These compact plants are members of the brassica family. They were developed over a period of 15 years by Dr. Paul Williams of the University of Wisconsin. In this unit students design experiments which require the control of key variables while they manipulate only one. They collect and analyze data and discover the effects of the manipulation of their chosen variable on their plants.

***(C) Human Body Systems:**
This unit focuses on the interdependence of the circulatory, digestive, and respiratory systems of the human body. Students observe their own bodies while performing physical tasks and while resting to identify some of the processes taking place in the body, and are introduced to the differences between voluntary and involuntary processes. Microscopes are used to examine cells and experiments are performed to illustrate diffusion through cell membranes. Students build models of organs and systems to examine how the processes work. During the lessons, students explore the connections between structure and function, the nature of a system, and the interactions between the different systems that work together in the body.

***(D) There Is No Away:**
This unit helps students understand the impact that waste and its disposal has on their lives. Aspects that affect the students directly, solid waste disposal and water pollution, are emphasized, rather than the more global concepts of air and heat pollution. By setting up their own controlled experiments and building model landfills, students learn about what happens to organic and inorganic wastes over time and how rain affects the materials in the landfill. Students investigate some of the major steps involved in purifying water. Recycling and alternative ways to reduce the amount of discarded materials are discussed and students develop communication strategies to explain the problem of waste disposal to others.

Sources of the Project SEED kits:

(A) Magnets and Motors:	NSRC/STC
(B) Fast Plants	NSRC/STC (Experimenting with Plants)
(C) Human Body Systems	EDC Insights
(D) There is No Away	EDC Insights

Communications

with parents and the community

PROJECT SEED NEWSLETTER

Science for Early Educational Development

Project S.E.E.D. is a Collaboration of Pasadena Unified School District and the California Institute of Technology

A letter from P.U.S.D.:

Project SEED has become one of the most innovative and exciting instructional programs to be implemented in the Pasadena Unified School District in recent years. As both an outstanding professional opportunity for our teachers and an exciting hands-on experimenting approach to learning for our students, Project SEED involves our schools in a national leadership role in science education excellence.

A collaboration between the PUSD and the California Institute of Technology, Project SEED is a hands-on, kit-based elementary science curriculum. The program has now been extended to twenty elementary schools in the district, involving kindergarten through fifth grade. Beginning in February, Project SEED will be extended to sixth grade classrooms in the the original schools as well.

Project SEED students working with the hands-on science kits are presented with opportunities to learn by doing science themselves. Being able to actually do science, rather than having to read about it or memorize facts, allows all students to participate, regardless of their reading level or language background. In addition, as the students become excited about discovering, exploring, and experimenting with science lessons, they learn to apply this inquisitive approach to all subjects. This enthusiasm for learning can only have positive effects on student efforts in our school district.

Dr. Michael Klentschy
Associate Superintendent of Schools
Elementary Education Instruction

Read about crayfish and the "marble scale" on the next page...

Crayfish observers in Dean Cooper's class at Field Elementary School

From the SEED Staff:
We have been thrilled with the excitement students have generated in their classrooms. You will be able to see examples on the next few pages of students' work and teachers' efforts. We hope that as this project expands into every classroom in the elementary schools, parents and community will get involved in Project SEED. Teachers have enjoyed the interaction and professional exchange that has taken place during the SEED workshops.

Jenniler Yuré, Project Coordinator
Dr. Leila González, Caltech Liaison
Mary Abrahamian, Secretary
Yvonne Hoffman, Resource Teacher
Laurie Thompson, Resource Teacher
Elizabeth Hamilton, SEED Newsletter
José Marquez, Head Kit Builder
Heather Anderson, Student Kit Builder

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A letter from Caltech:

The desperate need for better science education in elementary schools is of immediate and critical importance. Children need to be exposed to real science experience in order to be able to participate in our technologically-based society. Information about environmental crises, biological and chemical technology, space exploration, and innovations in the computer industry will be increasingly difficult to understand and more importantly, evaluate, without at least a basic knowledge of science.

We believe that working scientists have a responsibility to help educate our children about science and the process of doing science. This is the reason we are enthusiastic about the partnership that has developed around Project SEED between Caltech and the Pasadena Unified School System. From all appearances we are on the way to building an exemplary local elementary school science program.

While we are excited about the local efforts to improve science education, we are also very aware of the increasing national attention on this subject. In fact, Project SEED may very well become a national model for university/public school and scientist/teacher interactions in improving the quality of science instruction. In the spring of this year, for example, Caltech and PUSD will host a national workshop on this subject. One focus of this workshop will be on our local efforts to employ working scientists in the training and support of classroom teachers. The continuing interaction of Caltech Scientists and PUSD teachers, administrators and students seems quite likely to have a far reaching effect on early science education.

Dr. Jim Bower, Prof. of Biology, Caltech
Dr. Jerry Pine, Prof. of Physics, Caltech

Hello! This newsletter is designed to keep everyone, teachers, students, parents, and Project SEED staff, in touch with what is happening with Project SEED. This first issue will share some of the innovative ideas teachers have used to expand the role of Project SEED in their classroom, such as a way to introduce parents to Project SEED at Open House last semester, and some of the practical benefits that result from Project SEED, like problem-solving skills. In addition, student samples from this year and a few from last year are highlighted, and other small articles about Project SEED are included.

We hope this newsletter will become a place for teachers and students to communicate their strategies and creative thoughts about using Project SEED in their classroom. Any comments or suggestions for the newsletter are welcome, please call Jennifer Yuré or Elizabeth Hamilton at the SEED office, 791-8932.

Some Great Ideas

At Sierra Madre Elementary School, the students in Dorothy Hall's fifth grade class took their Batteries and Bulbs experiences a step further than the lessons in the kit. Each student designed and built a Batteries and Bulbs term project. After using the lessons in the kit to learn about closed circuits and series and parallel systems, the students were able to build unique projects on their own. Three of the projects are described here.

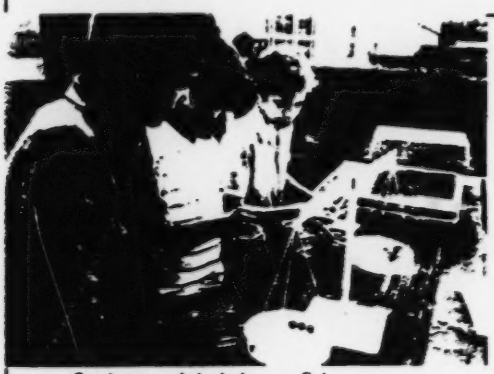
After learning that batteries have acid in them, Renato O'Neil wondered if the acid in lemons would act like battery acid. For his project, Renato hooked lemons together with wires and paper clips. When he connected the wires to a small light bulb, the bulb lit up! It took 4 lemons to light up a bulb the size of a Christmas tree bulb.

Justin Bell made a closed circuit out of 2 D size batteries, some wire, a paper clip, a brass paper fastener, and a small light bulb. He then built a small house out of cardboard and placed this over the circuit. When he closed the circuit (connected the paper clip to the brass fastener), the light shone through the windows of the house.

Mrs. Hall's class experimenting during the Mystery Powders unit.

For his project, Ryan Riley built a closed circuit connected to both a toy helicopter propeller and a light bulb. He used a small motor taken from a toy electric car to turn the top propeller on the 6 inch helicopter made of legos, and hooked up a small light bulb to the front of the helicopter. When he connected the motor and the light bulb to a D size battery, the propeller turned and the light shone.

Working on these projects helped the students find examples in everyday life of the scientific definitions they had just learned in the classroom.



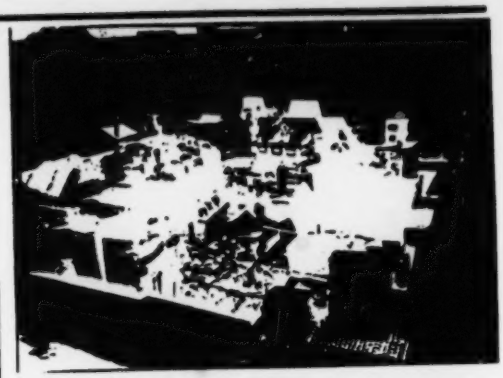
Students weigh their crayfish

Mr. Cooper's fifth grade class at Field Elementary School demonstrated their problem solving skills while working with the Crayfish unit this quarter. One of the crayfish observations involves weighing the animal, but Mr. Cooper's classroom didn't have a set of gram weights to use with the scale. The class brainstormed together, and came up with the idea of using a different measuring system, a system which would use something that could already be found in the classroom. The students now measure the crayfish in marble units; a typical crayfish is equivalent to the weight of three marbles, and a large crayfish weighs four marbles. When Mr. Cooper's class gets gram weights to use with the scale, they will convert the marble system into the metric system, and extend their science lessons into mathematics.

Examining a rubbing from the crayfish shell.

Learning to solve problems creatively is what Project SEED hopes to encourage in every student. Rather than wait to continue the unit until a set of gram weights could be found, the students in Mr. Cooper's class tackled the immediate problem and came up with an alternative measuring system.

Mary Golden's third grade class at Allendale Elementary School had fun at the end of their Structures unit, when Mrs. Golden gave them all a building project for homework. They were to be the sole architect and designer of their "Dream House," and build it using materials like straws, toothpicks, popsicle sticks, index cards, paper clips, marshmallows, construction paper, and rubber bands. After doing the lessons in the kit and learning about tension, compression, gravity and support, the students used the appropriate materials for the different parts of their houses.



The "Structures City" at Allendale Elementary

Pictures of how people change

For last fall's Open House, **Ilene Reinfeld at Cleveland Elementary School** set up four Project SEED science stations in her second and third grade classroom. When her students visited their classroom with their parents that night, the students took their parents through the Project SEED stations and demonstrated what they had been learning. From the live animal kit, there were containers of water with brine shrimp in them and magnifying glasses. From the Scientific Reasoning kit, pendulums were set up to experiment with, including worksheets for recording predictions and observations of experiments. The students helped their parents build with the plastic drinking straws and straight pins that were set out as an example of the Structures kit. Bowls of water and pieces of clay were available from the Clay Boats kit, and everyone tried their best to make their "boats" float.

The children had a great time sharing their scientific knowledge with their parents, and the parents had fun learning about the science.

Student Work

April Price

The Vinegar Test

Chalk = It makes the chalk smoother, a bigger and it makes the water white it makes a foamy sound, and there are lots of flakes and bubbles

Lime stone = sound like soda pop make sizes, white bubbles. Water turns gray / black quartz Nothing

Portia Clark's split second and third grade class at Jackson School enjoyed the Rocks and Charts unit. Here are April Price's observations during the vinegar test and Kevin Allen's chart of rock characteristics

rock	I look	surface	layering	streak	weight	color
agate	shiny	rough	no	yes	light	black
bricks	shiny	rough	yes	no	light	black
calcite	shiny	rough	no	yes	light	gray
pink feldspar	shiny	rough	no	no	light	pink
white galena	shiny	rough	no	yes	light	white

Kevin allen

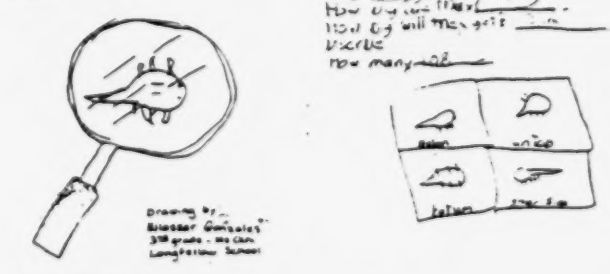
Jovani

My caterpillar

I have a caterpillar. My caterpillar is black. My caterpillar's name is Roy. I picked that name because. I like it.

At Longfellow Elementary School, Barbara Bigby's second graders wrote about their caterpillars during the Butterflies and Moths unit. Above is Jovani Banuedo's description.

Last year, in **Linda Ochi's third grade class at Longfellow School**, Eliassar Gonzales drew this journal entry during the Brine Shrimp unit.



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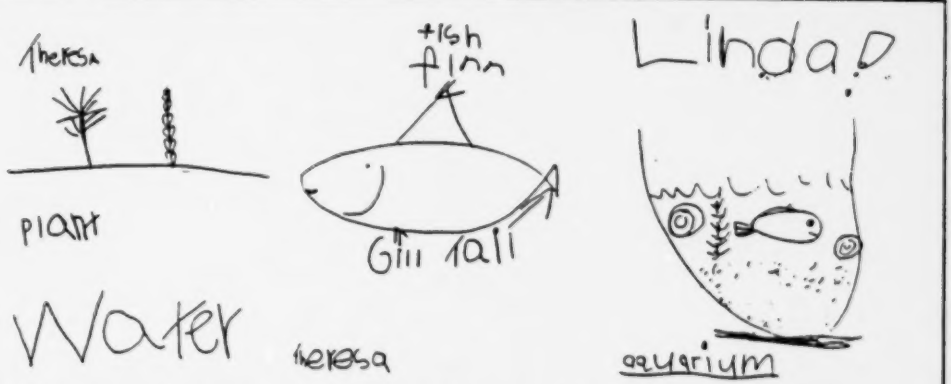
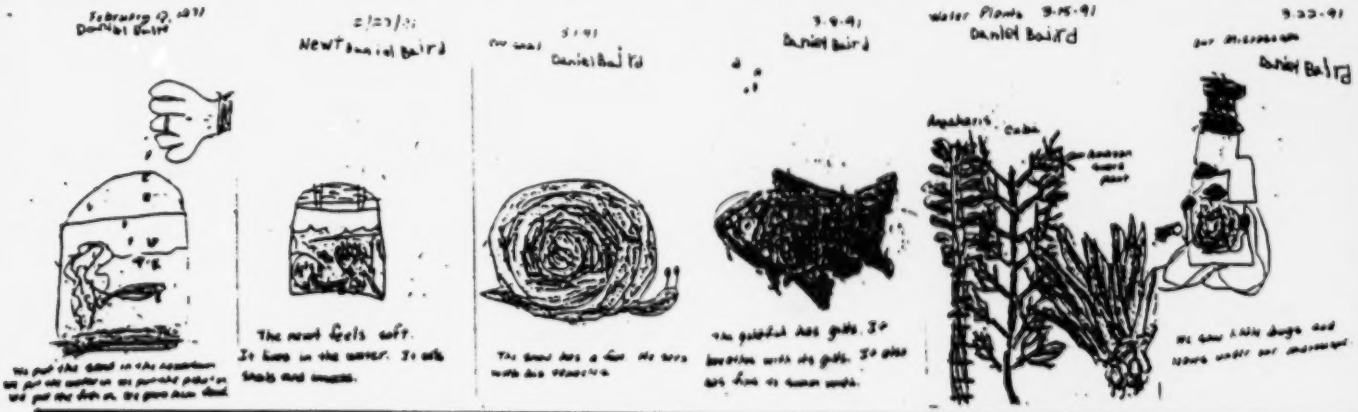
More Student Work

At Sierra Madre Elementary School, Barbara Wambolt's kindergarten class drew pictures of their aquarium to keep a log of the unit. Theresa Hare has drawn part of the oxygen cycle in an aquarium. The water plants put oxygen into the water, and a fish uses its gills to breathe the oxygen in the water. In her drawing, Linda Phan has included the little bottle of water clarifier dripping into the aquarium.



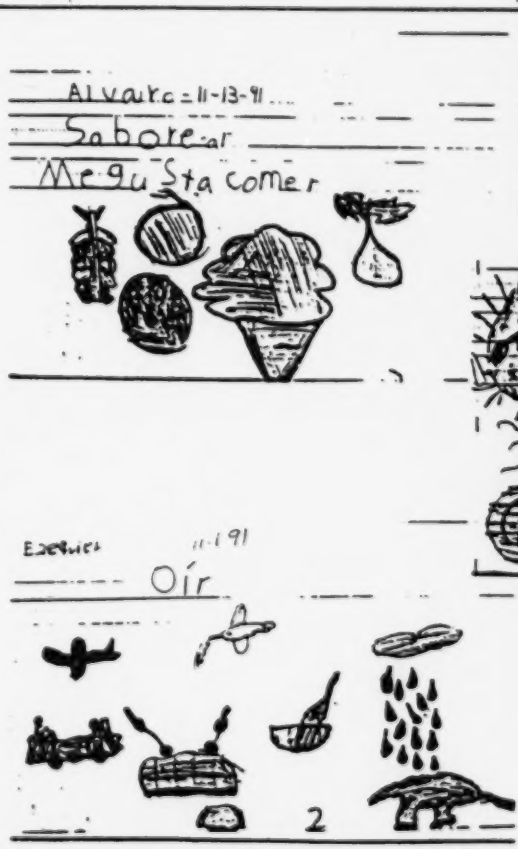
Last year, in **Joan Morris' kindergarten class at at Longfellow School**, Daniel Baird drew this series of aquarium pictures.



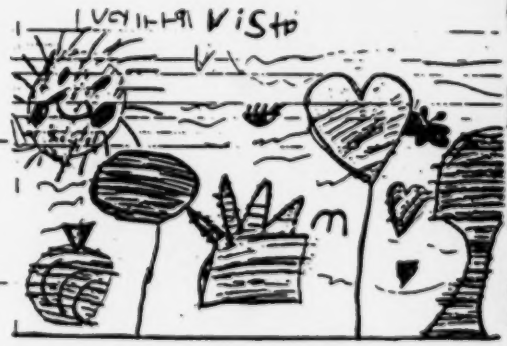
SEED HOUSE

Caltech has designated one of its buildings, a house at 287 S. Hill, to be the Project SEED House. As well as serving as office space for Project SEED staff and some of the other Caltech community outreach programs, it will be available for Project SEED meetings. In fact, although the house still needs some renovation work before it is ready to be fully occupied, it was used for the Project SEED teacher inservices January 7 - 24, and February 2 - 4, 1992.

Project SEED would like to thank **Angel's Pet Store** for providing us with live animal supplies according to our school schedule. They go out of their way to order supplies on a quarterly basis for us. Thanks Angel's!



During their Senses unit, **Joycene Gallaher's bilingual first grade class at Jackson Elementary School** drew pictures to illustrate the different senses. To the left is *Saborear* by Alvaro Delgado, and below are *Oír* by Ezequiel Castro, and *Visto* by Lucy Lucas.



Project SEED NEWSLETTER
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PROJECT
SEED
Science for Early Educational Development
NEWSLETTER

Project S.E.E.D. is a Collaboration of Pasadena Unified School District and the California Institute of Technology

At Linda Vista Elementary School, Ellen Calvert's 4th grade class is extending their Project SEED experiences with the Pasadena Armory's "Children Investigate the Environment" program. The program includes local field trips to Devil's Gate and Eaton Canyon, as well as classroom work, for six fourth grade classes each year. The schools involved in the Armory program rotate each year. Educating students about the importance of maintaining ecological balances and conserving resources are principal goals of the Armory program.

Examing pond water in 4th grade at Linda Vista

The students work with an artist, a poet, civil and environmental engineers, and naturalists to talk about the ecological balances of plants, animals and people, water conservation, and the enhancement of natural and man-made areas with environmental planning. By exploring the environment with not only a factual and scientific approach, but also an emotional and artistic approach, the students make a stronger connection to what they are learning.

At the end of the school year, the students present their discoveries and ideas about protection and preservation of the Devil's Gate natural environment to the Pasadena City Council. The program organizers hope that after this experience, many students will continue to be advocates for the preservation and responsible use of their environment.

In the classroom, the students also investigate the environment with Project SEED 4th grade kits. In the kit Small Things, the students use microscopes to look the small organisms that live in a pond water environment. Using the Rocks and Charts kit, the students learn about different kinds of rocks, some of which they see in their natural environment during the field trips.

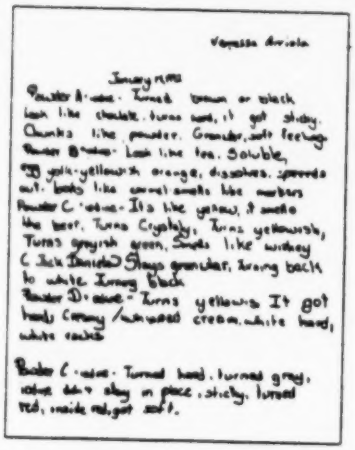
The Pasadena Armory program, "Children Investigate the Environment," has become one example of a valuable collaboration for both Project SEED and the Pasadena Armory's community program. "This program really touches kids," said Mrs. Calvert, "They will always remember this part of 4th grade." By extending science lessons into everyday life, the collaborations with community resources allow Project SEED to have a greater influence on students. Strong support from the community thus contributes directly to the sucess of this classroom hands-on science program.

What's happening?

At Willard Elementary School, the students in Ginny Kajiwara's fifth grade class did challenging experiments with the Mystery Powders kit. After weeks of testing all five mystery powders with water, vinegar, iodine, and heat, the students were able to draw conclusions from the data about what the five mystery powders might be. The next experiment involved using this data in a more complicated situation. Instead of pure samples of the individual powders, the students now performed the water, vinegar, and iodine tests on six new samples. These six samples were either some of the same original powders, or a maybe mixtures of two powders. Drawing upon their experiences from the first round of tests, the students were able to determine which powders were in each of the six samples.

What the students didn't know though, was that this experiment was what is called an "embedded assessment" for the kit, designed to test how well the students had learned the experimental procedure. As with most Project SEED lessons, the kids were so excited about doing the experiment, they didn't realize it was a test.

In collaboration with Caltech and the University of California at Santa Barbara, Project SEED is working on developing assessment lessons like this for all the kits because most traditional testing methods don't adequately assess what the kids are learning by using hands-on science lessons. Once developed, these tests will serve as a national model for a new kind of testing. The spontaneous enthusiasm and excitement generated in Mrs. Kajiwara's class may be an indicator of a positive new attitude toward tests.



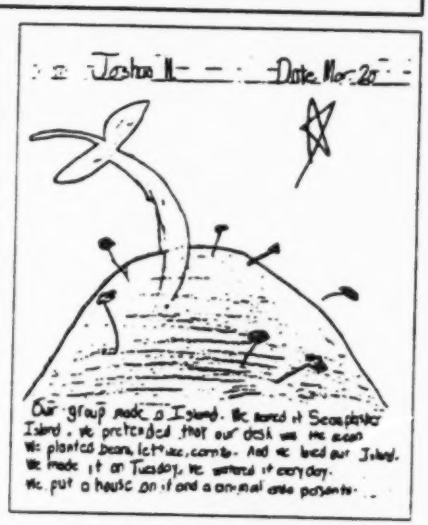
Vanessa Arriola's data from the mystery powder iodine test

Three creators and their island

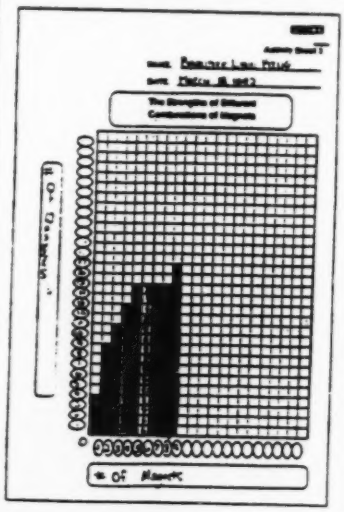
At Don Benito Elementary School, Suellen Bowman's first grade students built small islands out of clay and sphagnum moss to learn about seed dispersal. The students planted corn, beans, and lettuce seeds under the moss and discussed the ways the seeds could have been put there naturally, by wind, water, animals or people. When the seeds started to grow, the students pretended the corn and beans were trees, and that the lettuce was bushes, and made little houses, people, and animals for the islands.

As well as seed dispersal, the students learned lessons about drought with their islands. When they forgot to water the islands, the plants died, so they replanted and watered the new seeds.

Mrs. Bowman's class practiced writing skills when they wrote descriptions of their islands and stories with an island theme.


Joshua N
Date Nov 20
Our group made a Island. We named it Seaplants Island. We pretended that our desk was the ocean We planted beans, lettuce, corn. And we loved our Island. We made it on Tuesday, We watered it everyday. We put a house on it and a animal and peoples

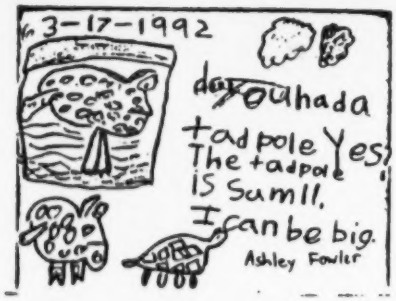
Joshua Newsome wrote and drew this description of his group's island.

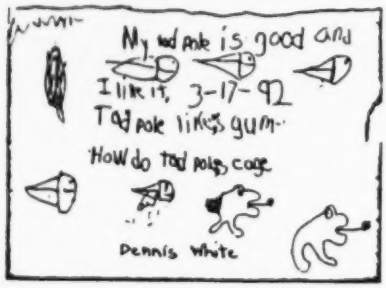


This spring semester is the first semester for Project SEED in 6th grade classrooms. At Cleveland, Field, Franklin, Jackson, Jefferson, Longfellow, Madison, Noyes, San Rafael, and Sierra Madre Elementary Schools, sixth graders began using the Magnets and Motors science kit in February to learn about how motors work and the role of magnets in motor operation.

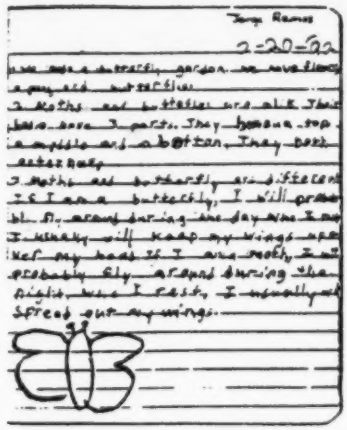
At Jefferson Elementary School, Julie Castro's sixth grade class is having a great time using their science kit. One lesson involved using plastic straws, plastic cups, short pieces of wire, and magnets to build compasses, and another examined the strengths of different combinations of magnets.

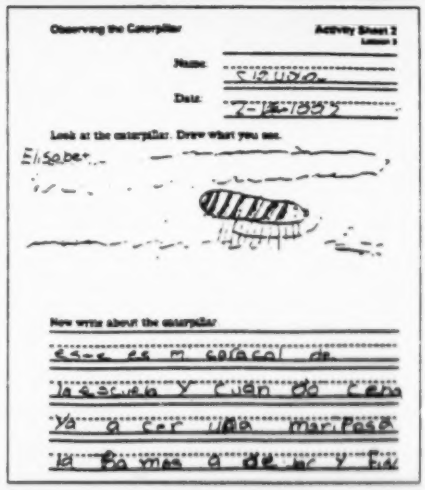
"Wow, the compass even works on my nose!"





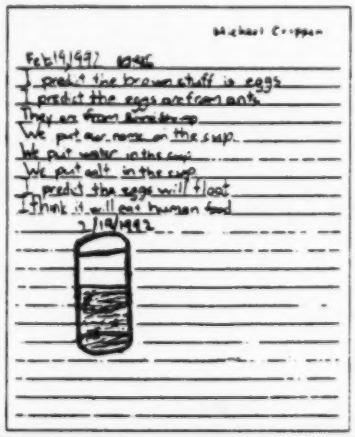
Ashley Fowler and Dennis White from **Mark Halcromb's 1st grade class at Edison Elementary School,** drew these observations during the Frog and Tadpole unit.

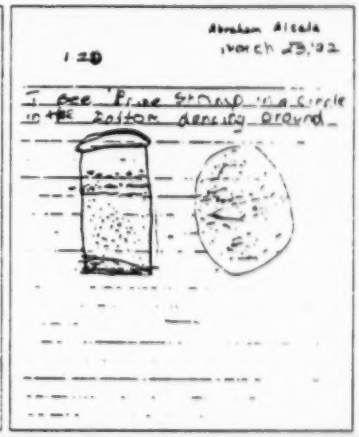


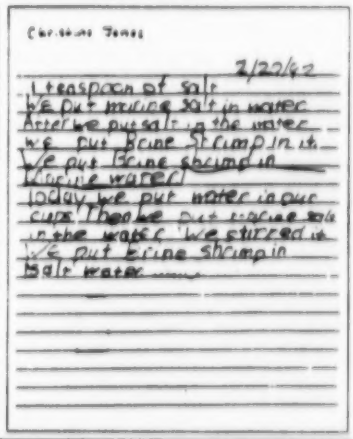


During their Butterfly and Moth unit in **Ruby Bryant's 2nd grade class at Jefferson Elementary School,** Jorge Ramos wrote this journal entry, Claudia Dominguez wrote this description in Spanish, and Alicia Odom put this butterfly life cycle in order.

These are journal entries about the brine shrimp unit from Michael Crippen, Abraham Alcala, and Christine Jones. They are in **Ouida Eskildsen's class at Edison Elementary School.**


Michael Crippen
Feb 19 1992
I predict the brown stuff is eggs
I predict the eggs are from ants
They are from Brine shrimp
We put our nose on the cup
We put water in the cup
We put salt in the cup
I predict the eggs will float
I think it will eat human food
2/19/1992




Christine Jones
2/22/92
1 teaspoon of salt
We put marine salt in water
After we put salt in the water
we put Brine Shrimp in it
We put Brine shrimp in
Brine water
today we put water in our
cups Then we put marine salt
in the water We stirred it
We put Brine Shrimp in
Salt water

In José Herrera's class at Willard Elementary School, Felipe Robles, a 1st year transition (from Spanish to English) reading student wrote these observations about mealworms, the live animal kit in 4th grade.

When I first got my mealworm, it had twelve segments and it had it had some little black eyes. The mealworm had really smooth skin. My mealworm was two inches. Its color was brown and yellow and the mealworm was little circle. And it had two little antenae and it had six feet. The feet were little and they were short. The tail had some antenae. The antenae where small, they were smaller than the head's. The skin had a little dust and it smelled funny. My mealworm made diffrent movements. One of the things my mealworm did was climb books and rulers. And my mealworm walked though a straw. My worm sometimes went slow and sometimes it went fast. When I held my worm it tickled my hand. Sometimes my worm pumped when I moved its tail. The mealworm sometimes rolled over. When you flashed a light at the mealworm it went backwards. My mealworm liked to sleep a lot. And he liked to eat a lot of bran. The mealworm liked to move a lot on my table and run a lot. The day, my mealworm started to change. When I got my mealworm, the color was brown and the other day the skin started to fall off. Then my mealworm got smaller and it was fatter and the mealworm still had six legs. The mealworm had smaller antenae and it did not want to eat a lot of bran. Then some things changed on its body. The tail got a lot smaller. When I got my mealworm I thought that it wasn't going to turn into a something but it looks like it will. The reason my mealworm changed was because it needs to change into something Its name now is pupa. I think it is going to change into a fly.

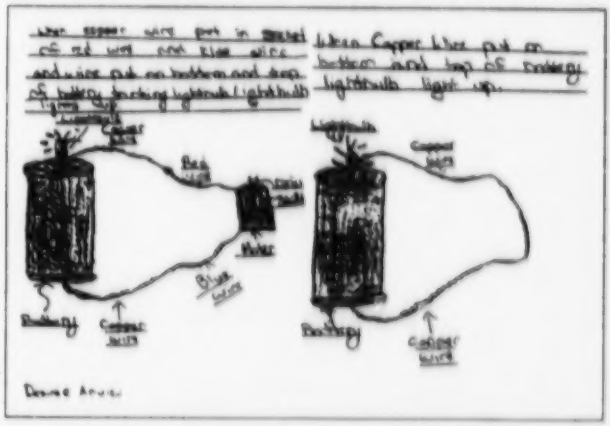
Scientists' Support

A vital component of Project SEED is the working support we receive from scientists. During teacher training scientists model the scientific process, helping teachers to see teaching science as teaching a questioning process rather than a set of facts. The following is a list of scientists who are currently or have been involved with Project SEED:

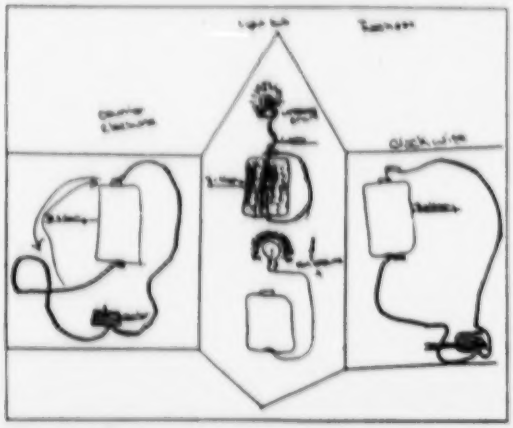
Chris Assad	Electrical Eng., Caltech	Kerry La Prade	Engingeering, Hughes Aircraft Co.
Wyeth Bair	Neural Networks, Caltech	Maurice Lee	Biology, Caltech
Talal Balaa	Environmental Eng., Caltech	Roger Lighty	Biology, JPL
Pierre Baldi	Neural Networks, JPL	LeVal Lund	Caltech Alumnus
Upi Bhalla	Biology, Caltech	Peter Mason	Engingeering, JPL
Pam Bjorkman	Biology, Caltech	Paul Miller	Applied Physics, Caltech
Geoff Blake	Cosmo Chemistry, Caltech	Josée Morissette	Biology, Caltech
Dale Burger	Engingeering, JPL	Mark O'Dell	Biology, Caltech
Arvid Croonquist	Caltech Alumnus	Laurie Patterson	Chemistry & Physics, AAUW
Joe Dobrowolski	Civil Eng., Caltech Alumnus	Jane Sanders	Biology, Caltech
Lisa Dahm	Bio., City of Hope Med. Res. Inst.	Jennifer Sevilla	Biology, USC
Annmarie Eldering	Environmental Eng., Caltech	Caroly Shumway	Biology, Caltech
Jack Gallant	Biology, Caltech	Scott Strobel	Biology, Caltech
Giri Gundapa-Sulur	Biology, Caltech	Joanne Topol	Biology, Caltech
Al Hibbs	Physics, Caltech	Howard Topp	Engineering, Hughes Aircraft Co.
Charles Holland	Caltech Alumnus	Vick Veysey	Engineering, Caltech Alumnus
Wendy Katz	Biology, Caltech	Don Wilkinson	Engineering, Caltech Alumnus
Julie Kornfield	Chemical Engineering	Kai Zinn	Biology, Caltech

More Student Work

While doing the Myself and Others kit, Lupe Villagrana and Pedro Villegas from Miss Binky's (Kim Thornhill's) morning kindergarten class at Willard Elementary School created these drawings.



In Ray Ellis's fifth grade class at Burbank Elementary, Desiree Aruizu and Rashaan Nall drew diagrams of battery and light bulb circuits.



Project SEED NEWSLETTER
Vol. 1, No. 2, Late Spring 1992
Edited by Elizabeth Hamilton

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Pasadena, CA 91103
(818) 791-8932

Project SEED House
California Institute of Technology
Mail Stop 1-98
Pasadena, CA 91125
(818) 356-3222

Thank you,

Chuck Larson and Company, for making Project SEED's metal pieces for our 4th grade microscopes. We appreciate the support from the community!

All-New-Stamping-Company
1081 Lower Azusa Road
El Monte, CA 91731

PROJECT SEED

Science for Early Educational Development

NEWSLETTER

Project S.E.E.D. is a Collaboration of Pasadena Unified School District and the California Institute of Technology

Project SEED is the Pasadena Unified School District's elementary science program. It is a hands-on approach, where students learn about science by actually doing science. Instead of the traditional science textbooks, kits of science materials are provided to classroom teachers. Using these materials, students turn their classrooms into scientific laboratories where they make and record their scientific observations, make predictions, and perform their own experiments. Because hands-on science is as productive as it is fun for both students and teachers, science is fast becoming the favorite subject in many classrooms.

Throughout the year, the Project SEED Newsletter will show some of the interesting activities classes are doing during their science lessons. In this first issue for the 1992-1993 school year, an overview of all the kits at each grade level is provided, illustrated with a few examples of scientific observations from student journals.

Please let us know if you have any questions or comments about the newsletter; the SEED office can be reached at 791-8932. Thank you.

Jennifer Yuré, Program Coordinator

Students from Henry Robles' first and second grade combination class at Linda Vista Elementary School are excited about hands-on science. (Judith A. Barnett photo)

At Hamilton Elementary School, Adrienne Eggleston and her kindergarten students discuss similarities and differences during a Myself and Others science lesson.

Connections

One of the exciting aspects of Project SEED is that doing science involves integration of all classroom subjects. For example, children use communication and writing skills to describe and record scientific observations, mathematics to compare data, and reading skills to learn more about the subject. This helps children make connections from one discipline to another.

Adrienne Eggleston, a bilingual kindergarten teacher at Hamilton Elementary School, pointed out that one of the kindergarten science kits, Myself and Others, perfectly complements themes in the Spanish Language Reading Program and English Language Development Program units.

During the Myself and Others science unit, students are introduced to the importance of making accurate observations in science. To practice making and describing observations, students discuss the similarities and differences between themselves. The lessons in the introductory kindergarten bilingual curriculum focus on identity and "Being Myself." Because the program themes are so similar, integration between the bilingual and science curriculum is natural.

Look for other examples of integration in the samples of student work on the next few pages.

Project SEED Science Kits

Kindergarten

(A) Beginning Senses: Students learn to identify the body parts associated with each sense, and how their senses help them interact with their environment.

(B) Myself and Others: By investigating similarities and differences among people, students practice observational skills and develop descriptive language as they measure, compare and classify.

(C) Pond and Aquarium: Students observe three aquariums containing a water plant and a fish, a snail, or a newt to learn about an aquatic environment.

(D) Sunlight and Shadows: Using flashlights and sunlight, students experiment with their own shadows and the shadows of other objects to explore some of the more common characteristics of light and shadows.

Students in Adlean Collier's kindergarten class at Edison Elementary record shadows formed by flashlights.

After experimenting with salad oil and a feather in a cup of water, students in Barbie Floyd's class at Burbank Elementary last year recorded these notes in their science journals.

First Grade

(A) Growing Seeds: Through the activities, students learn about the characteristics and behavior of seeds, life cycles of plants, and identification of basic plant parts and growth patterns.

(B) Senses: As a continuation of the Kindergarten Beginning Senses unit, students focus on the importance of senses in learning about their surroundings and interpreting the world around them.

(C) Frog and Tadpole: Students observe the complete process of metamorphosis of a tadpole and discuss the different stages as it develops into a frog.

(D) Pollution and Ecology: Students develop an awareness of pollution by doing experiments to observe pollutants in the air and water and on the land.

Second Grade

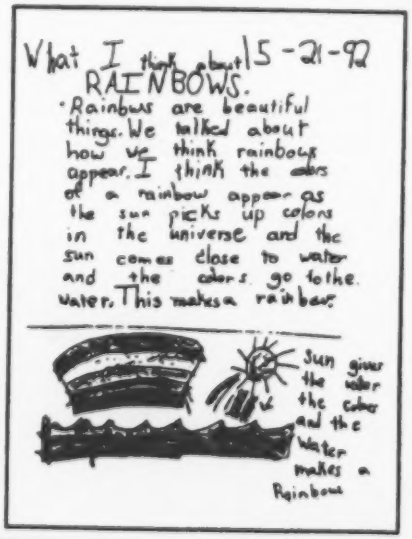
(A) Magnets: Students experiment with the properties of magnets to learn about how magnets attract, and the conditions affecting magnetic attraction.

(B) Weather: During this unit, students observe, measure, and record weather changes, and investigate the different elements which determine the weather.

(C) Butterflies and Moths: Students observe, predict, classify, and record the life cycle of a caterpillar as it turns into a butterfly or moth.

(D) Changes: By observing changes in themselves, the people around them, and nature, students are introduced to both physical and chemical changes, and the effects of change.

At Noyes Elementary School last year, Denise Johnson's second graders talked about rainbows during the Weather unit. This page is from Chelsea Bagnard's science journal.


What I think about 5-21-92
RAINBOWS.
Rainbows are beautiful things. We talked about how we think rainbows appear. I think the colors of a rainbow appear as the sun picks up colors in the universe and the sun comes close to water and the colors go to the water. This makes a rainbow.
Sun gives the water the color and the water makes a Rainbow

Third Grade

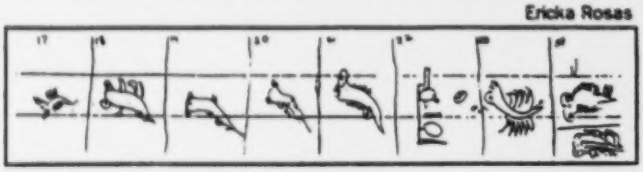
(A) Clay Boats: Investigations with clay and other materials introduce students to the principles of buoyancy, mass, density, and displacement.

(B) Structures: By building their own structures, students study the properties of building materials and explore different approaches to designing structures.

(C) Brine Shrimp: Students study the life cycle of the brine shrimp and learn to design their own experiments to test conditions which may affect the brine shrimp.

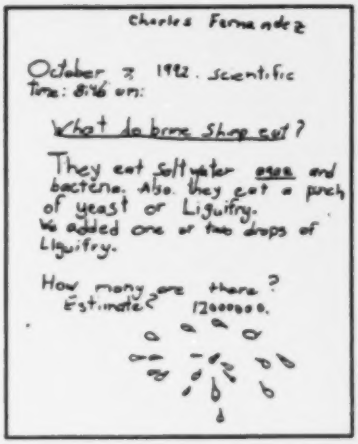
(D) Scientific Reasoning: Students are introduced to the concept of variables and the importance of controlling them. They design experiments to test their predictions about conditions affecting the experiment.

Ericka Rosas



Daniel Huerta

During the Brine Shrimp unit, students in Marni Mahaffay's third grade class at San Rafael Elementary School used time lines as well as their science journals to record their observations.



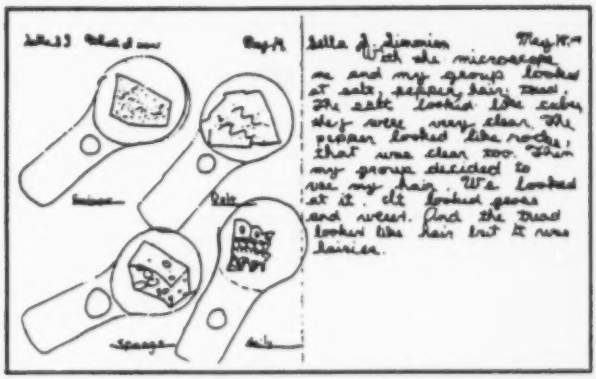
Charles Fernandez

October 7 1992. Scientific
Time: 8:46 am.

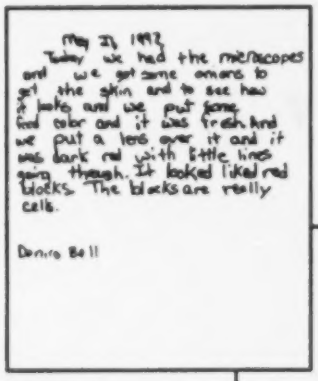
What do brine Shrimp eat?

They eat saltwater eggs and bacteria. Also they eat a pinch of yeast or Liquifry.
We added one or two drops of Liquifry.

How many are there?
Estimate? 12000000.



May 17, 1992
With the microscope me and my group looked at salt, pepper, hair, thread. The salt looked like cubes, they were very clean. The pepper looked like rocks, that was clean too. Then my group decided to see my hair. We looked at it. It looked gooey and weird. And the thread looked like hair but it was lumpier.



May 21, 1992
Today we had the microscopes and we got some onions to get the skin and to see how it looks and we put some red color and it was fresh and we put a lens over it and it was dark red with little lines going through. It looked like red blocks. The blocks are really cells.

Denise Bell

Beverly Hillstock's fourth grade class at Webster Elementary made detailed observations during the Small Things unit.

Ode to A Mealworm

I like to play
on a summer day
with my Mealworms Slimy Paul and
Wild Thing.
They always tickle me and
play in the sand
called "bran."
We have fun together and we will say
"Phew, what a day."
I looked at him close and saw his eye.
I guess he was shy
and backed away from me.
He wiggles around,
on the ground.
I hope he's not in trouble.
We both are on the double.
My worms and I are happy to say
that me and them
are a great team.

Kendra McAlister, May 29, 1992

At the end of the Mealworm unit, Michael Marcos' fourth grade class at Don Benito expressed their science experiences with poems.

Goodbye Herman III,
Asta La Vista,
Shlom, Adios

Today is my last day with you
Herman the 3rd
I think I liked you better
Than any kind of bird.
You were really fun to work with
Even when running everywhere
If I had taken my eyes off you
No more would you be there.
You helped me learn a lot of stuff
Which was really fun and neat
I also learned to check for you
Before sitting ...

Jessica Hallman, June 1, 1992

Fourth Grade

(A) The Environment and Its Pollution: Students explore properties of water, air, soil, and sound and perform experiments which help them understand how our environment becomes polluted and ways to prevent pollution.

(B) Rocks and Charts: By studying and sorting the properties of rocks, students are introduced to general processes of classification and how scientists use generalizing principles to create groups.

(C) Mealworms: Students are introduced to difficulties behavioral scientists encounter while attempting to control variables when working with a living experimental system.

(D) Small Things: In this unit, students become familiar with the use of microscopes and how tools can be used to enhance our senses. Students have the opportunity to construct their own scientific instruments.

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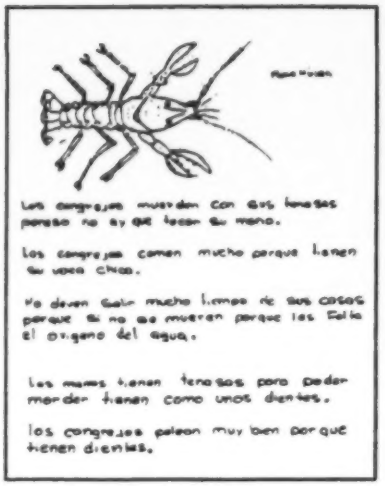
Fifth Grade

(A) Mystery Powders: Using five unknown similar white powders, students perform experiments to determine differences between the powders. They make inferences from their results and design additional experiments to test their predictions.

(B) Batteries and Bulbs: This unit is an introduction to the study of electricity and circuits with experiments using batteries, small light bulbs, various kinds of wire, and small electric motors.

(C) Crayfish: In this behavioral science unit, students design and perform experiments to answer their questions about the life of a crayfish.

(D) Daytime Astronomy: Students study the phases of the moon and the shadows cast by the sun. These records help the students formulate and revise their mental model of the universe.



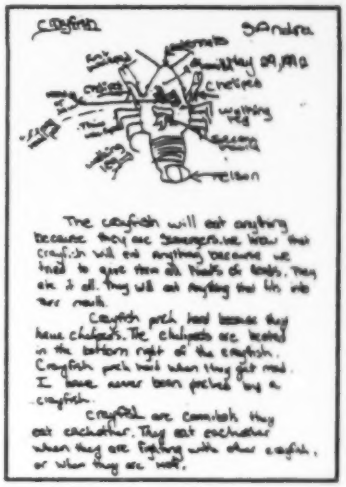
Los congrejos muerden con sus tenazas porque no hay que tocan su mano.

Los congrejos comen mucho porque tienen su vaca chica.

No deben cuidar mucho tiempo de sus cosas porque si no se mueren porque les falta el oxigeno del agua.

Los machos tienen tenazas para poder morder tienen como unos dientes.

Los congrejos pelean muy bien porque tienen dientes.

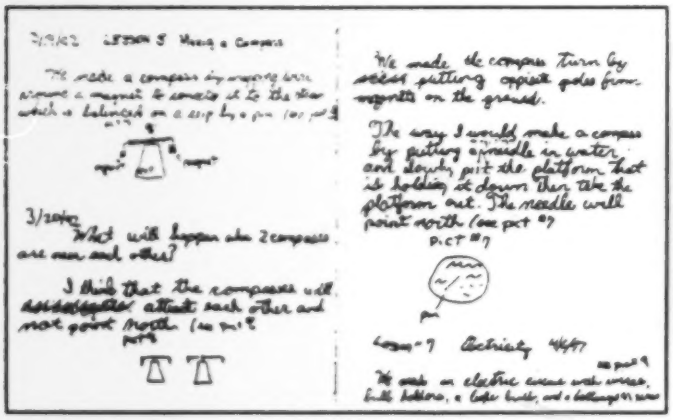


The crayfish will eat anything because they are scavengers. Now that crayfish will eat anything because we tried to give them all kinds of foods. They ate it all. They will eat anything that fits into their mouth.

Crayfish pinch hard because they have chelipeds. The chelipeds are located on the bottom right of the crayfish. Crayfish pinch hard when they get mad. I have never been pinched by a crayfish.

Crayfish are cannibals they eat eachother. They eat eachother when they are fighting with other crayfish, or when they are mad.

Students in Elaine Carlip's fifth grade class at Allendale Elementary wrote final papers after the crayfish unit.



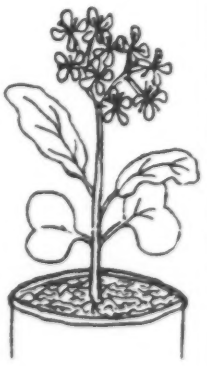
During the Magnets and Motors unit, students often need to refer back to their diagrams and notes during later lessons. Chris Allen in Ty Gaffney's sixth grade class at Sierra Madre Elementary School last year took these notes.

At Jefferson Elementary School, students in Julie Castro's sixth grade class last year tackled the challenge of building compasses with magnets and straws during the Magnets and Motors unit.

Sixth Grade

(A) Magnets and Motors: While investigating the connection between magnetism and electricity, students build on previous experiences to construct compasses, electromagnets, motors, and generators.

(B) Experimenting with Plants: Using the rapid cycling *Brassica Rapa* plant, which goes from seed to seed in about 40 days, students design experiments to observe the effects of one variable while controlling other variables.



Thank you!

Summer 1992, several students from Pasadena's high school academy programs worked for Project SEED, building and refurbishing kits. Many thanks to them for their help!

Name	Academy	School
Elena Roberson	Computer Academy	Marshall H.S.
Jamal Tillmon	Computer Academy	Marshall H.S.
Miguel Rosado	Computer Academy	Marshall H.S.
Ernie Benavidez	Finance Academy	Muir H.S.
Nydia Chambers	Finance Academy	Muir H.S.
Ronnie Littleton	Space Academy	Muir H.S.
George Sanchez	Space Academy	Muir H.S.
Brekida Johnson	Space Academy	Muir H.S.
Zaire Paxton	Space Academy	Muir H.S.

Project SEED NEWSLETTER, Vol. 2, No. 1, Autumn 1992, Edited by Elizabeth Hamilton
Project SEED, District Service Center, 740 Woodbury Road, Pasadena, CA 91103 (818) 791-8932

PROJECT SEED

Science for Early Educational Development

NEWSLETTER

Project S.E.E.D. is the Pasadena Unified School District's Elementary Science Curriculum

Pasadena's hands-on science curriculum is very successful at getting all the kids in the classroom involved in the lessons, regardless of background or skill level. For all students, being able to work with real, manipulative materials during science lessons helps them to understand abstract concepts better. Because many students have trouble processing information if they can only hear it or see it, they need to experience an activity themselves in order to make the connection between the idea and the reality. This method works very well in regular and special education classrooms.

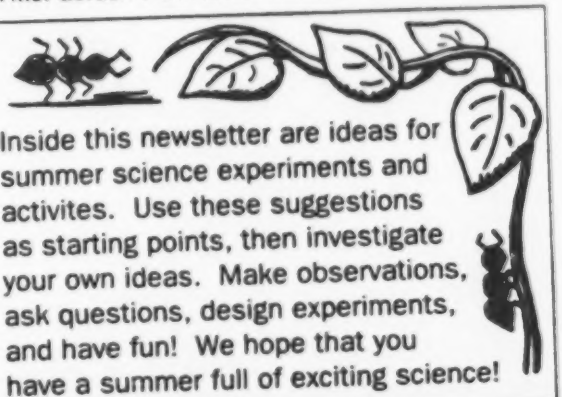
Fifth grade students in Kate Gordon's and Brian Smith's classes at Loma Alta Elementary are measuring the angle of the sun with shadow boards and protractors.

In Stephanie Welsh's class of first, second, and third grade special education students at Edison Elementary, taking care of tadpoles has been a powerful learning experience. The students prepared for the tadpole unit by keeping aquariums full of just water on their desks for a few days before the tadpoles were delivered. This practice session helped the students understand that their behavior has consequences. After the tadpoles arrived, the students took turns feeding them and learned about changing the water. Looking out for the tadpoles' needs helped the students become aware of their own physical needs, and how to be sensitive to other people's needs.

In many of Pasadena's elementary classrooms, special education students are included with regular education students for the entire day or parts of the day. Hands-on science in these classrooms has been extremely successful for the special education students because it helps them with language development, social behaviors, and establishing friendships as well as learning science concepts. The regular education students also benefit from the experience because it helps them develop patience and respect for others and make friends.

At Loma Alta Elementary, the special education students in Bryan Smith's class meet with Kate Gordon's fifth grade class for science lessons. Mr. Smith's students spilt up into small groups with Ms. Gordon's students. The non-threatening nature of the science activities where everyone is discovering something new at the same time allows the special education students to enjoy working in small cooperative groups. There are also other reasons why the students like the science lessons. Nicole Thomas from Mr. Smith's class explains that she enjoys science because she likes having the science materials to work with. Alan League says that he likes science because it is not boring.

The importance of hands-on science is apparent when the benefits are so evident in all kinds of classrooms, and with all kinds of students. As shown with the special education students' experiences, these benefits are not restricted to science activities in a classroom, but rather extend into a person's entire life.



Inside this newsletter are ideas for summer science experiments and activites. Use these suggestions as starting points, then investigate your own ideas. Make observations, ask questions, design experiments, and have fun! We hope that you have a summer full of exciting science!

The pebbles allow the excess water to drain away from the plant roots.

3. Use horticultural charcoal (if you have some) for the next layer. The charcoal acts as a filter so clean water will run down to the pebbles.

4. Cut up some old nylons to lay on top of the drainage bed. The nylons keep the soil from falling down into the bed.

5. Get some ordinary garden soil from the yard for the next layer. Make a layer of soil about 1 inch thick in the jar.

7. After you
the soi

8. Screw th
a rubb

9. Put the
direct

10. After a
of the
you cann
terrariu
of the
droplets

Hey! Science Trips for Kids and Par

Kidspace Museum

390 S. El Molino Ave. at California Blvd., Pasadena (818) 449-9143
open: Wed 2 pm - 5 pm; Sat - Sun, 12:30 - 5 pm
admission prices: $5 kids; $4 adults; $3.50 senior citizens; $2.50 kids ages 1 -2
parking: free in the lot behind the museum or on the street
This is an educational museum full of hands-on exhibits aimed at preschoolers through second graders. There are varied weekly programs, call for details.

Museum of Science and Industry

Exposition Park, Los Angeles (call for directions) (213) 744-7400
open: 10 am - 5 pm everyday, call for information about holidays
admission prices: free for everyone, except for the IMAX Theater which has admission fees
parking: available in a lot next to the museum for $3.00
Call for information about the current exhibits, the IMAX Theater, and science workshops.

Eaton Canyon Park and Nature Center

1750 N. Altadena Dr. at New York Drive, Pasadena
open: exhibit center hours: Tue.-Fri., 9:30 am-5 pm
Sat.-Sun. 9 am-4 pm; the park is open daily from da
admission prices: free for everyone
parking: available in lot on park grounds, free on wee
$3 fee on weekends and holidays
The exhibit center highlights the park's wildlife with
animals and a room full of live animals. The park offers
walks every Saturday at 9 am. Various hiking trails le
waterfall, or up to Mount Wilson.

Griffith Park Observatory

Vermont Blvd. at Los Feliz Blvd., Los Angeles (213) 66
open: Tue - Fri, 2 pm - 10 pm; Sat - Sun, 12:30 pm
admission prices: free to the Hall of Science and the
Telescope; tickets for planetarium shows are $3.50 adu
citizens; $2 for kids ages 5 - 12
parking: available for free in lots, but is limited
The Astronomical Telescope is open for public viewing
Tue. - Sun., 7 pm - 9:45 pm. Planetarium showtimes
3 pm and 7:30 pm, and Sat. and Sun. at 3 pm, 4:30
There is a special show for children under 5 on Sat. and

Wow! On June 26 and 27, 1993 there will be an **Open House at JPL** from 10 am - 4 pm each day. The entire
open, with demonstrations and presentations about JPL's current projects taking place all day. There is no admission charge,
Jet Propulsion Laboratory 4800 Oak Grove Dr. near Foothill Blvd., Pasadena (818) 354-9314

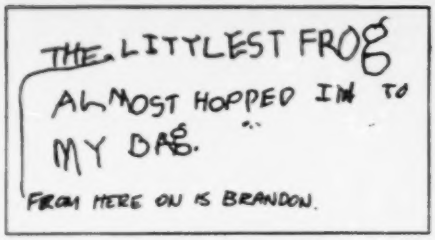
Parent Involvement

This spring, **Carol Kaplow's Kindergarten class at Don Benito Elementary** went on a field trip to see the lily ponds at Caltech. After the trip, the students took home a worksheet about their day for parents and students to complete together. Parents were asked to talk with their children about the trip to Caltech's ponds, and write down what the children remembered about the trip, the animals that they saw, how they knew the animals were alive, and what was new or interesting about anything they had seen.

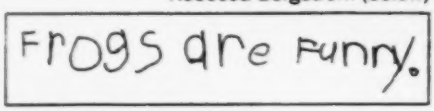
Students' answers were very descriptive. Alexander Champlin said, "I saw one frog hop and the turtle moved his head and that's all... and I saw some crayfish moving." Cheyenne Alisa Wood reported that she knew the animals were alive because, "They were breathing, jumping, growing - having a suntan." Scotty Kietzman observed, "The lily pads were alive because they were blooming." Lemmie Wells noted, "The colors of the frogs and the lily pads are almost the same." Randy Winter reported, "There were fish that had long whiskers." Jackie Lauterbach said, "I liked the slime because it was gooey and I had to scoop it out with a spoon."

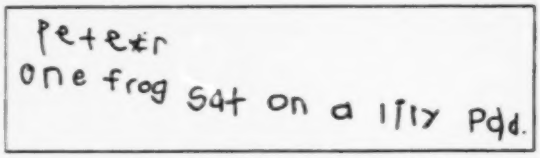
This kind of homework is a great way to involve parents in science lessons. Talking with the students about their experiences helps the students with verbal communication skills, as well as provides an additional opportunity for the students to think about what they have learned and to make connections.

Here is some of the students' own writing about their trip.

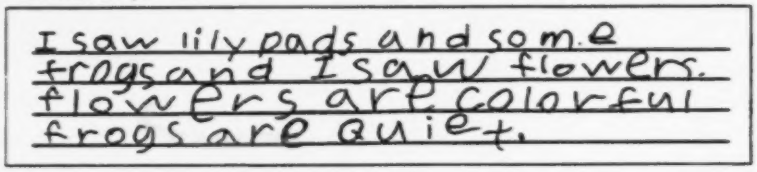


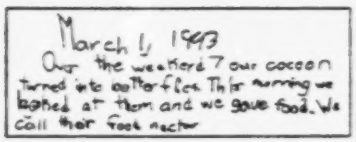
Brandon Schmiedeberg (above)
Rebecca Bergstrom (below)

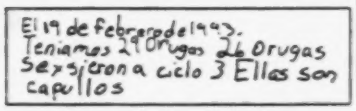


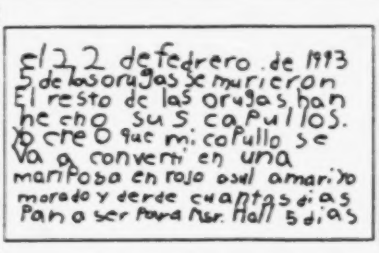


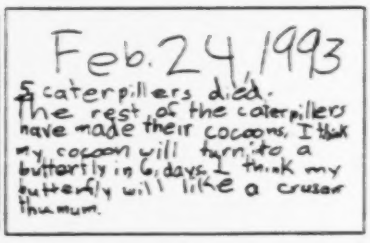
Peter Schofield (above), Angela Lin (below)




March 1, 1993
Our the weekend 7 our cocoon
Turned into butterflies Their turning we
laghed at them and we gave food. We
Call their food nectar




El 22 de febrero de 1993
5 de las orugas se murieron
El resto de las orugas han
hecho sus capullos.
Yo creo que mi capullo se
va a convertir en una
mariposa en rojo azul amarillo
morado y verde cuantas dias
Para ser para Mrs. Hall 5 dias


Feb. 24, 1993
5 caterpillers died.
The rest of the caterpillers
have made their cocoons. I think
my cocoon will turn into a
butterfly in 6 days. I think my
butterfly will like a cruzer
thumum.

During the Butterfly unit, **Liz Hall's second grade students at Madison Elementary** recorded these observations. Left to right: Stephanie Vasquez (top), Isabel Castillo (bottom), Jesus Omana, Kimberly Costa

Live Animal Science Units

Although the live animal science units in the primary grades focus on observation of life cycles, such as the tadpoles in first grade and the caterpillars in second grade, the emphasis during the live animal units in the upper grades is on animal behavior. Students design behavioral experiments to investigate their questions about the animals' lives.

These baby crayfish are only one half-inch long.

Occasionally however, the opportunity to observe animal life cycles also happens in the upper grades. Last fall one female crayfish in **Dianne Flood's fifth grade class at Field Elementary** laid hundreds of eggs that hatched into tiny transparent crayfish. The students have enjoyed watching the babies slowly develop. In **Leanne Camilling's third grade class at Longfellow**, the brine shrimp that the students hatched from eggs a few months ago laid their own eggs and a second generation of baby brine shrimp have now hatched. These unexpected extensions of the science unit are providing a rich science experience for the students.

Students in Dianne Flood's fifth grade class show off a few of their big crayfish, which are about 5 inches long.

Fill Your Summ

This summer after school is out, don't forget to keep
Whenever you have a question about how or why so
works the way it does, see if ***YOU*** can figure it out.
Use this chart as a guide:

Make observations
What do you see?

Ask Questions
Do you have a question about what you have observed?

Make a Prediction
What do you think will happen?

Experi
Design an experiment t
Conduct the
Collect
Analyze yo

Think about your prediction a
Did your experiment help you answer your
Do you have more questions now?
Can you design another experimen

Summer 1993

Keep a science journal to record all your ideas, questions, experiments, and observations. You can use a regular notebook, or make your own journal with sheets of paper and cardboard for a cover.

C

Record y

Make a Terrarium.

48

A terrarium is a collection of small plants growing in a closed jar or an old aquarium that acts as a tiny, self-contained ecosystem.

1. Find a very large clear jar or a similar container with a lid.

2. Use small pebbles for the bottom layer.

6. Find som
dig up a
the plant
then cov

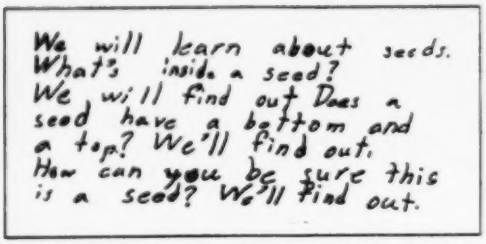
You can
small stic
you wou

Students in Ginger Chulack's fourth grade class had a chance to check out the stream at Devil's Gate.

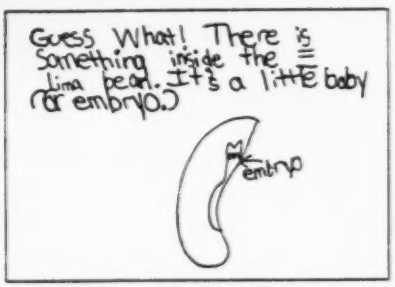
Last October, **Ginger Chulack's 4th grade class at Jackson Elementary** went on a field trip to the Devil's Gate Hiking area with the Pasadena Armory's Investigate the Environment program. During the trip, the children worked in small groups with a naturalist, an artist, and a poet to discuss geology, plants and the water cycle. After observing the water in the streams and discussing the components in the water cycle, students imagined themselves as a water drop and drew pictures to illustrate their ideas. Another activity was to find rocks that matched a variety of paint sample colors that included everything from magenta to olive green to bright blue. The students were surprised when they realized they could find a part of a rock to match almost any color if they looked hard enough.

The Investigate the Environment Program complements the fourth grade science curriculum, and encourages integration between science and other classroom subjects. By showing the students how to use skills which the students do not typically associate with science, such as drawing, imagining, and making unusual comparisons, the Armory Program helps diversify the thought processes that students use in their science investigations.

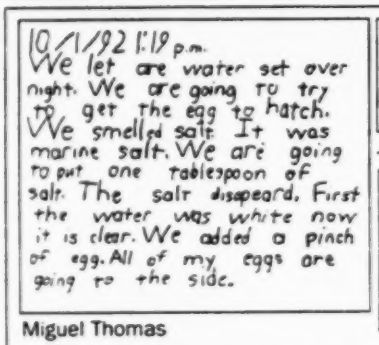
*During the fourth grade science unit, Environment and Its Pollution, students in **Joycelyn Knight's class at Hamilton Elementary** test the pH levels of mountain and garden soil.*


We will learn about seeds. What's inside a seed? We will find out Does a seed have a bottom and a top? We'll find out. How can you be sure this is a seed? We'll find out.
Seeds
This is a lima beans.
something inside?
Let's predict
7 says no
19 says yes

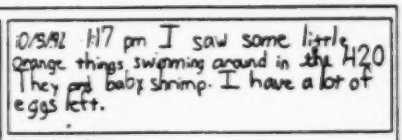
Kristian Luzon (above) Shonné Catimon (below) Christina Correa



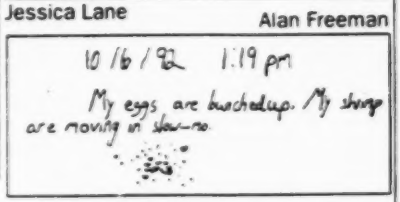
To learn more about seeds, students in **Barbara Dale's first grade class at Webster Elementry** dissected lima beans that had been soaked in water. The students kept track of their investigation in their journals.


10/1/92 1:19 p.m.
We let are water set over night. We are going to try to get the egg to hatch. We smelled salt It was marine salt. We are going to put one tablespoon of salt. The salt disapeard. First the water was white now it is clear. We added a pinch of egg. All of my eggs are going to the side.

Miguel Thomas

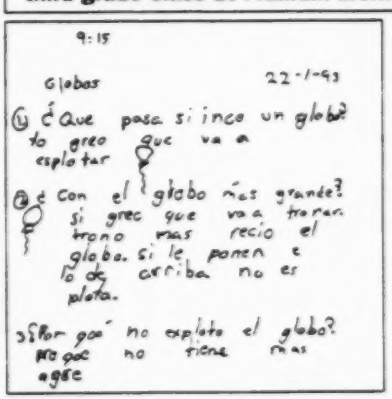


Jessica Lane



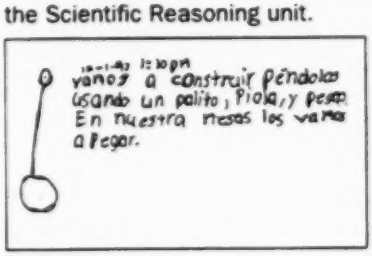
Alan Freeman

These brine shrimp journals are from students in **Opal Hampton's third grade class at Franklin Elementary.**

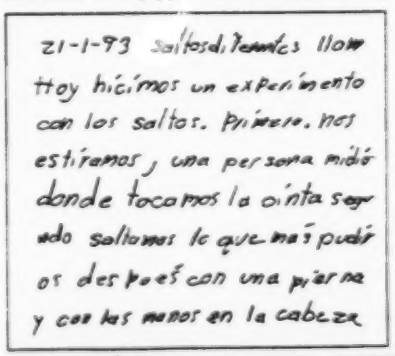

9:15
Globos
22-1-93
① ¿Que pasa si inco un globo to greo que va a explotar
② ¿ Con el globo más grande? si greo que va a tronar trono mas recio el globo. si le ponen e lo de arriba no es plota.
¿Por qué no explota el globo? Porque no tiene mas agire

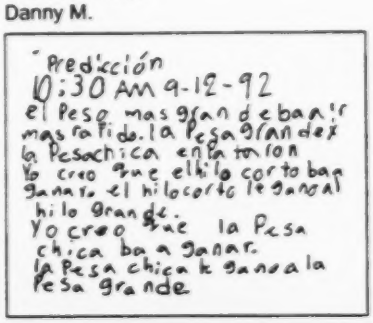
Gricelda Rios (up), Lilia Mendoza (down)

Students in **Priscilla León's third grade bilingual class at Madison Elementary** took these descriptive notes in their journals during the Scientific Reasoning unit.



Ana Laura S.Q.
Danny M.


21-1-93 Saltos de Pesas Hoy hicimos un experimento con los saltos. Primero, nos estiramos y una persona midió donde tocamos la cinta segundo saltamos lo que más pudimos después con una pierna y con las manos en la cabeza

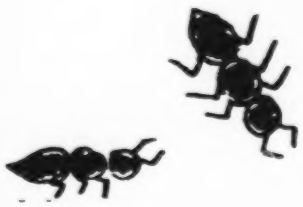

Predicción
10:30 AM 9-12-92
el Pesa mas grande bana ir mas rapido. la Pesa grande y la Pesa chica en la misma Yo creo que el hilo corto bana ganar. el hilo corto le ganal hilo grande.
Yo creo que la Pesa chica ba a ganar.
la Pesa chica le gana a la Pesa grande

r With Science!

oing science activities and experiments.

ething

Here are some activities to start with:



What do Ants Like to Eat?

While you are outside playing this summer, keep an eye out for ant colonies. (Stay away from red ants because they might bite.)
You can design experiments to find out what kinds of foods ants like best.
Find a clean paper plate with low sides that ants can climb over.
Mark the paper plate off into 6 or 8 sections with a pencil or pen.
Put small, equal amounts of different foods in each section on the plate.
Put the plate in a place near the ants' home, but away from buildings and birds.
Check on the plate in half an hour to see which foods the ants like best.
Are the ants taking the food away with them?
Where are the ants taking the food?
Keep notes on your ant experiments in your science journal.

Have questions?
Look for information about your experiments at the library.

t!
your prediction.
eriment.

ata.

in.
ion?

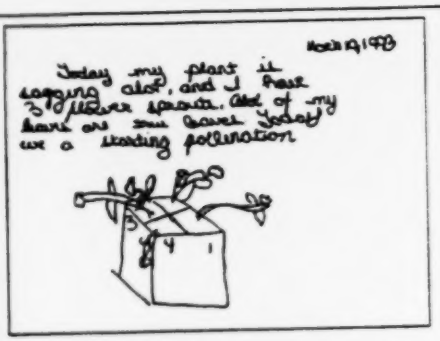
nunicate your results.
eople about what you did.
experiment in your science journal.

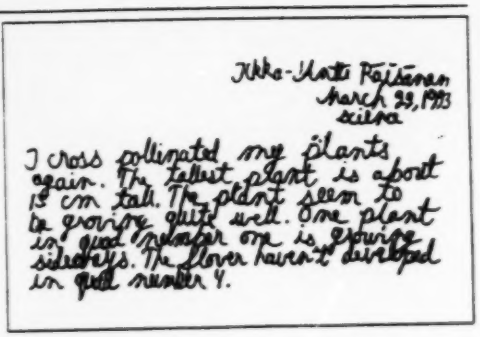
nall plants that you can
t in your terrarium. Arrange
tiny forest or however you like,
ne roots with more soil.

nall decorative rocks, some
o use as trees, and whatever else
to add to your terrarium scene.

Start a rock collection.

See how many different kinds of rocks you can find around the neighborhood, and whenever you take a trip. The library has books that can tell you what kinds of rocks you have, and how the rocks were formed. An empty egg carton is a good place to store your rock collection.




Ilkka-Matti Räisänen
March 29, 1993
Selma
I cross pollinated my plants
again. The tallest plant is about
15 cm tall. The plant seem to
be growing quite well. One plant
is quite smaller one is growing
sideways. The flower haven't developed
in yet number 4.

At Allendale Elementary, sixth graders in Nancy Bartlett's class are working on the Fast Plants unit. In this photo, students are cross-pollinating their Brassica rapa plants with dried bees glued to wooden sticks. These journal entries are from Chanelle Bryant (left) and Ilkka-Antte Räisänen (right).

Science for the Community

Parent Night at Longfellow

In March, Longfellow Elementary hosted parent representatives from all of Pasadena's elementary schools for a night of hands-on science. The workshop was designed to introduce parents and community members to what was happening in classrooms during science lessons, and how volunteers could support science activities both in and out of school.

Two parents work together to test the effects of exercise on heart rate at Longfellow Elementary during a science workshop for parents.

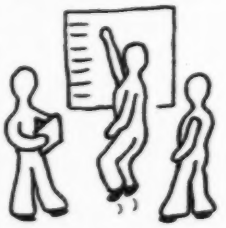
People who attended the workshop participated in active experiments from the third grade Scientific Reasoning kit, which is a designed to teach students about variables. While comparing and discussing the results of stretching and jumping contests and people's heart rates after exercising for varying amounts of time, the parents experienced the enthusiasm and excitement that students are experiencing whenever they have science at school.

Now a group of parents from each school has a better idea of what the district science program is about. It is hoped that this group will assist the schools in setting up more science nights for their school's community in the coming year. Parents interested in organizing science activities for school events can contact the principal at the school, or the Pasadena Elementary Science Office at 791-8932, for more information.

Caltech's Outreach Programs for Improving Precollege Science are Expanding

The hands-on, inquiry based components of Pasadena's elementary science curriculum were introduced eight years ago in a pilot program, Project SEED, which was designed by Caltech faculty and PUSD teachers. Since then, as Project SEED became the PUSD elementary science program, those Caltech professors, Jim Bower and Jerry Pine, were able to expand their efforts to improve science education at all levels of precollege education. Their large collection of outreach programs has now been named the "Caltech Precollege Science Initiative" (CAPSI).

Currently, CAPSI includes the expansion of the SEED teacher training model into Pasadena middle schools and ninth grade. Another CAPSI project that affects Pasadena teachers is the development of a course for interested current teachers and students learning to be teachers at the Claremont Graduate School of Education. The course prepares them to teach an inquiry-based, hands-on science curriculum. Other components of CAPSI are a collaboration with the UCLA School of Library Science to develop a kid-friendly computer library catalog to help children access science books and other materials in school and public libraries, and the development of a training institute for school districts and their corporate or university sponsors interested in using Project SEED as a model to improve their own district science programs.



Jumping Investigations

Project SEED
NEWSLETTER
Vol. 2, No. 2
Spring/Summer 1993
Edited by
Elizabeth Hamilton
Project SEED
District Service Center
740 Woodbury Road
Pasadena, CA 91103
(818) 791-8932

...arranged everything as you want it, sprinkle
h water until it is damp, but not soaked.

id on tight. (You can use plastic wrap and
and to cover the jar if the lid has been lost.)

arium near a bright window, but NOT in
ght because it will be too hot.

hours, look for water droplets on the inside
rium walls. If there is so much moisture that
see inside, there is too much water in the
Take the lid off for a few hours to allow some
ture to evaporate. If there are very few water
none at all, add some water to the soil.

11. Once you have a nice collection of water droplets, leave the lid on tight and congratulate yourself. You probably do not have to worry about watering the plants again. You can sit back and watch your tiny ecosystem grow.

?? *Why don't I have to water the terrarium?*

The water in your tiny ecosystem is constantly being recycled by the plants. Water is taken up by plant roots and used by the plant as the plant grows. The excess water is given off by the leaves as water vapor which condenses on the sides of the terrarium and runs back down to the soil to be absorbed by the roots again.

ts!

398-5420

dusk

ys,

stuffed wild
nily nature
st a 20 ft.

191
m
nomical
$2.50 senior

clear nights,
ue. - Fri. at
nd 7:30 pm.
n. at 1:30 pm.

lex will be
arking is free.

Blow Some Bubbles.

Make a bubble solution out of:
1 quart of water
1/4 cup (2 oz.) hand dishwashing detergent
12-15 drops of glycerin.
(Glycerin can be bought at a drug store.)

Pour the bubble solution into a shallow pie pan or other flat container.
Experiment with different items to blow bubbles with.
Some ideas are:
cardboard rolls from paper towels
wire hangers bent into interesting shapes
string
paper cups with holes in the bottom
anything else you can think of

What makes the biggest bubbles?
The smallest bubbles?
The strongest bubbles?
The most bubbles?

Experiment with different concentrations of soap and glycerin, too.
Keep notes and drawings about your
experiments in your science journal.

Next fall, bring your summer science journals to school to share with your new class. We would love to show some of your summer work in the next newsletter!

SEED

Science for Early Educational Development

NEWSLETTER

The S.E.E.D. Program is the Pasadena Unified School District's Elementary Science Curriculum

SEED Science Journals

Why do we use journals when we are doing science? What is the benefit to science? What is the benefit for students?

These and other questions are being addressed by the teachers and students in the Pasadena Unified School District. Science is all about questioning and searching for the answers. As our students participate in this process, they use their science journals to record their observations, questions, and predictions. During experiments, students record the materials, method, results, conclusions, new questions, and new predictions.

Journals quickly become one of the most important scientific tools the students have. As students observe growth patterns, compare variables, or notice time or temperature influences during an experiment, they write these observations in their journals to refer to later. Students quickly learn how important it is to record data accurately and consistently when they refer to their journals to report their results or revise their experiment. Students rely on their journals when designing new experiments to answer new questions.

A first grader at Don Benito contemplates the litter her group collected and then sorted as part of the Pollution and Ecology unit.

The youngest students begin the scientific process of recording their observations with pictures and a few key words. As students get older, they begin using more words to describe what they have seen and done, and some of their drawings transform into diagrams. With experience, students begin organizing their data and thoughts into charts and graphs as well as lists and essays.

In addition, science journals are a springboard for curriculum integration. There is a natural connection between language arts and math and science journals. Descriptive words are essential for recording observations, and many students use poems or stories to represent their scientific observations. Math concepts like counting, measuring, and graphing are fundamental components of scientific inquiry. All science journal entries are examples of curriculum integration.

The next few pages show fine examples of PUSD student science journals. Take a look!

Jennifer Yuré, SEED Coordinator

Science Notebook Page #4A

Name Brandee Henry

How Tall I Am

I am just as tall as Frank

Ameia is taller than I am.

Adriana is shorter than I am.

Here is a page from Brandee Henry's journal from the Myself and Others unit in Denise Laing's kindergarten class at Loma Alta Elementary.

Kindergarten students in Donald MacBath's and Joyce Faust's class at Noyes Elementary are playing a game about their senses and shapes during the Beginning Senses science unit.

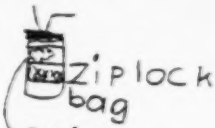
During the Butterfly and Moth unit, Marsha Smith's second grade class at Altadena Elementary pretended they were caterpillars inside their cocoons. Here is a creative journal entry by Erin Macklin.

Erin Macklin Feb 16 1994

I hear Noisey children.
It is pitch black.
I smell my food.
I cannot taste Malva for here.
I feel my Cocoon it is like an ice Cream cone around me.

In the photo, students in Linda Benn's second grade class at Franklin Elementary are observing their butterflies in aquariums.

10-8-93

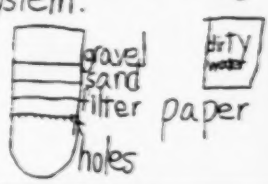


In this journal entry, first grader Aaron Santiago describes the Air Particle Detector he made during the Pollution and Ecology unit in Delores DeMayo's class at Willard Elementary.

During the Pollution and Ecology unit in Stella McStay's first grade class at Roosevelt Elementary, after Erin Buck made a water filter, she drew a diagram in her journal.

1-20-1994

on Friday we made a water filtering system.



December 13, 1993
Time 1:12

I see my Buttflys tongue is curling up all the time after he drinks something.

Eben Miranda from Sonja Gund's second grade class at Hamilton Elementary recorded this interesting observation in his journal during the Butterfly and Moth unit.

During the second grade Changes unit, Karen Rosano in Sonja Gund's class at Hamilton Elementary recorded this multiple-day experiment in her journal.

October 6, 1993
Time 2:25

steel wool
vineger science
water cup

I think the steel wool will change to gold.

October 8, 1993
Time 12:57

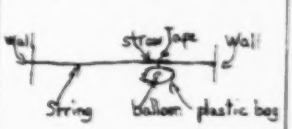
I see the waterand the vineger change color orage.

October 11 1993
Time 1:10

Over the weekend my steel wool changed to orage.

Vladi Zamalloa from Candida Enriquez's third grade class at Willard Elementary recorded this journal entry about an experiment during the Scientific Reasoning unit.

Balloon Flight Vladi
Materials: String
tape crpins Straw
plastic bag balloon



1st Experiment = balloon fell
2nd Time = balloon spun around
Materials: Red Balloon
straw tape
string
I predict ballon will go far
I predict the bigger ballon will go as far as the little

Prediction Oct 6 1993

I think when it hactches it is going to look like a baby ant. I think that it is going to bet tiny and small.

Experiment

I want to see if it is a antegg

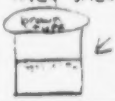
Materials

1 12oz cup
1 cup of water
1 tblsp of sea salt
1 spoon
brown stuff - eggs

Science - Seed

The wite water got clear. It looks like plane water. It looks like a heracane.

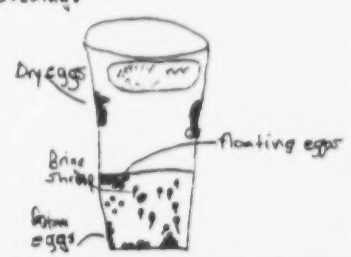
They are all floating above the water. It smells like fish food and it looks like fishfood. They stick to the cup.



Here Jenny Quintero explains her predictions and observations from the first experiment she did during the Brine Shrimp unit in Barbara Bray's third grade class at Field Elementary.

NOV. 5, 1993

My fish are geting bigger. And they swim faster. My water is geting brown. Why are some other eggs never hatching?



In Barbara Bray's third grade class at Field Elementary, Juan Cabral had a question about his brine shrimp eggs during the Brine Shrimp unit.

1:05 December 3, 1993

The teacher is going to give us eye droppers to see how they reacted to water and light. My big mealworm does it like water. He almost drowned. My little mealworm does it like water ether. My big one likes the light. My little one does it like the light. When my little ones get inside the water the get stif.

Then after I put my mealworms I took them outside in the sun so wouldis get cold. When I took them outside in the sun they stayed still for a long time.

During the fourth grade Mealworms unit, Shyla Smith in Marjorie Klages class at Loma Alta Elementary recorded her observations as a narrative with a few illustrations.

Below, Kenneth Moreno recorded this experiment in Segundo Belmar's bilingual class at Madison Elementary during the fourth grade Environment and its Pollution unit.

Gene Cuatt from Wendy Averill's class at Altadena Elementary chose to record some of his observations during the fourth grade Mealworms unit in a chart.

Piedras 1-20-94

Roca	color	brillo	forma	capas	escribe a lapiz	escribe en el papel
#1	café	si	cuadrado	si	si	si
#14	negro	si	Triangulo	si	no	no
#19	gris	no	cuadrado	si	si	si
#20	gris	no	Hexágono	si	no	no

Tres escribian son 1 M

During the Rocks and Charts unit in Segundo Belmar's fourth grade class at Madison Elementary, Frank Kein Melendez created this chart about his rocks.

Can mealworms see?
I think they can see food.
Will put food all around and put meal worm in middle and see what it does.

CHART

	TIMES
Bran	
chip	
Bread	
Grass	
Nothing	

My meal worm likes bran and bread but did not like chips. It does not like alcohol. It likes water.
Yes I think they can't see.

10-26-93

Predicción

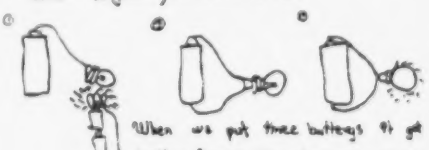
Cuando se le agrega agua caliente al repollo yo creo que reba a cambiar o talves sele ba ir el color.

El repollo es morado y de adentro el aromapo es muy fuerte. era un poco duro. Yo observe que cuando le agregaron el agua caliente al vaso con repollo morado Despues el agua se puso muy morada. El repollo flotaba.

Yo creo que mañana el vaso baa estar mas morado.

Lessor #3 Oct-25-93

Goal: Lighting the bulb



When we put three batteys it get brighter. Because it got more energy

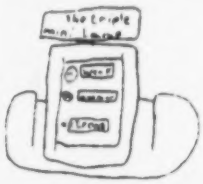
Wires getting hot. I think that is because the energy of the battery.

① More then one way to light the bulb.
② Wires got hot.
③ Top (+) of the battery got hot.
④ The light bulb got hot.

Ericka Rosas recorded her observations and her ideas about why things happened during the Batteries and Bulbs unit in Dawna Tully's fifth grade bilingual class.

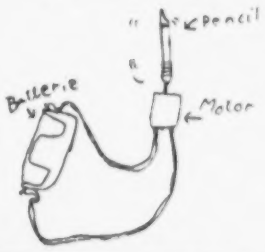
Ben Olsen
12/8/93

I worked on a project I call it Triple Mini Lamp. The batteries seem dead so I have to take it home to fix it. It is very complicated so my Dad will help me.



Ben
12/10/93

Today I worked on motors I of my pencil and stuck it on motor so when I turned it on the pencil Spun around.



Above, Ben Olson from Lloyd Watson's fifth grade class at Altadena Elementary made these notes and drew these diagrams about his electrical projects during the Batteries and Bulbs science unit.

A student in Armen Antonian's sixth grade class at Jackson Elementary checks her journal for her previous observations about her landfill experiment during the There Is No Away unit.

Waste Dump

1/6/94

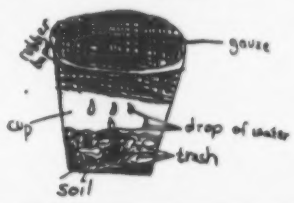
1. Material

A gauze C cup
B rubberband D stickers
E trash: Orange Peel, bread, lettuce, nail and broccoli
F. soil

2. Procedure: First we got the cup and put some trash (orange peel, bread, lettuce etc) in and then we put in soil. We layered it until the trash couldn't be seen. Then on a plain, white sticker we wrote our names and all the trash we put inside. We got a piece of cloth (gauze) and covered the cup. Then we put a few drops of water Then we were done!

3. Hypothesis: I think that all the trash is going to decay except for the nail. The nail is going to rust but it is not going to decay or disappear like the other trash.

4. Illustration



In Katherine Ellis's sixth grade class at Cleveland Elementary, Mahlet Bekele outlined her landfill experiment in her journal very thoroughly during the There is No Away unit.

Science Journals at Caltech

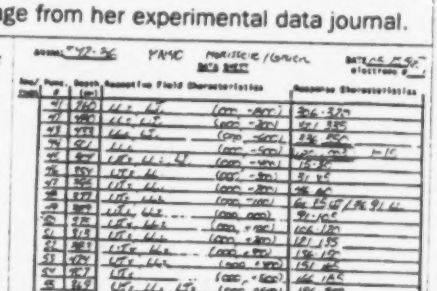
During inservices with PUSD teachers, scientists from Caltech have been sharing their own journals and showing teachers how journal entries are used in their research.

Joseé Morisette, a graduate student at Caltech who is studying how the brain works, keeps three different kinds of journals. One is a journal of her notes to herself about her experiments. She maintains a separate journal to record the exact data from an experiment, numbers and figures that need to be analyzed. Yet another representation of Joseé's work is a published article in a professional science journal.

Here is a sample from Joseé's journal of notes to herself about her experiments, and a page from her experimental data journal.

6 ♀ June 10, 1993
born 05/11/93 30 days old
Unilateral

1. 102.5 g 05-0340: left ear
2. 104.4 g 0640 2 left ear
3. 97.5 g 0640 1 left ear



Thank you, Dr. Klentschy! **GOOD LUCK** in your new position. Your efforts to help implement and support a successful science program in the Pasadena elementary schools have been appreciated by teachers and students. Thank you for attending the workshops and visiting the classrooms. You made a positive difference that we will all remember!

The SEED Staff

Many Thanks! Volunteers from the American Association of University Women (AAUW) and retired PUSD employees have been helping PUSD build the science kits. The SEED Program staff, and PUSD teachers and students truly appreciate the help! Thank you, Mary Jane Diehl, Martha Hackman, Marjorie Munster, Susan Streeter, Carol Sturtevant, Helen Topp, Rose Webb, and Helena Wiebe.

SEED NEWSLETTER; vol. 3, no. 1; March, 1994
Edited by Elizabeth Hamilton; SEED Program
District Service Center, 740 W. Woodbury Rd.
Pasadena, CA 91103 (818) 791-8932

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Professional Development

SUMMARY OF EXPANSION SCHEDULE

Year 1

10 schools
1 teacher per grade at each school

Year 2

20 schools (10 already on board, 10 new)
2 teachers per grade at the 10 Year 1 schools
1 teacher per grade at the 10 new schools

Year 3

22 schools (20 already on board, 2 new)
3 teachers per grade at the 10 Year 1 schools
2 teachers per grade at the 10 Year 2 schools
1 teacher per grade at the 2 new schools

Year 4

22 schools
All teachers on board

K-6 TEACHER PROFESSIONAL DEVELOPMENT

Year 1:

One week summer institute
- Pedagogy
- Assessment
- Kits A and B

Resource teacher visits bi-weekly

Two day winter institute
- Kits C and D

Year 2:

One week summer institute
- Kit critiques
- Cross-curriculum integration

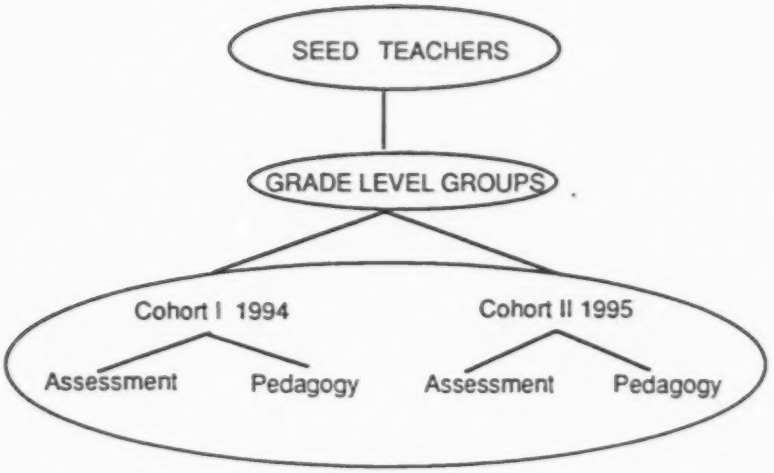
Resource teacher visits, as needed

Year 3 and after:

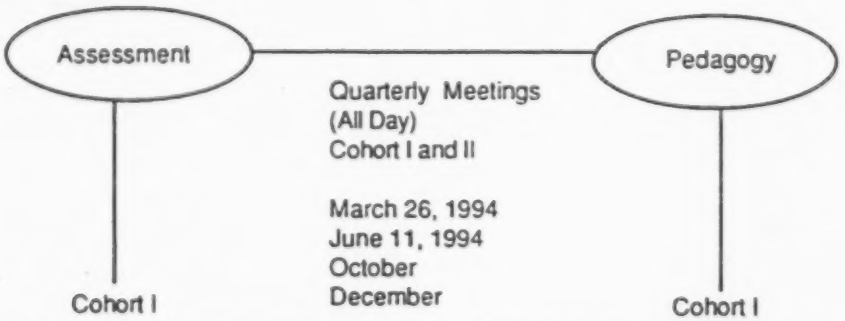
Grade level working groups in pedagogy, content, and assessment.

LEVEL II SEED

EISENHOWER:



TIME COMMITMENT:



Monthly meetings with assessment team (3 hours).
Other meetings or assignments as needed.

Monthly meetings with pedagogy team (3 hours).
Other meetings or assignments as needed.

STIPEND: $500.00 January-June
$500.00 September-December

EVALUATION: In an effort to evaluate Level II SEED, Tim and/or Jennifer will arrange to interview you and/or observe in your classroom on several occasions over the next year.

Eisenhower Grant: Level II SEED
Cohort I: Assessment Team
Calendar

Dates	Monthly Meetings	Quarterly Meetings
	February 3-8	
	March 3-8	March 26
	April 14-19	
	May 12-17	
	June 2-7	June 11

Day of the Week	After School	Evening
Thursday		6:30-9:30 **2nd Grade**
Friday		
Saturday	8:00-11:00 AM **5th Grade**	2:00-5:00 PM **4th Grade**
Monday	2:45-5:45 **Kindergarten**	6:00-9:00 **1st Grade**
Tuesday		6:30-9:30 P.M. **3rd Grade**

Eishenhower Grant: Level II SEED
Cohort I: Pedagogy Team
Calendar

Dates	Monthly Meetings	Quarterly Meetings
	February	
	March	March 26
	April	
	May	
	June	June 11

Day of the Week	After School	Evening
Monday	**Third Grade**, 3rd Mon. 2:45-5:45 Alternate loc.	**Fifth Grade**, 4:00-7:00
Tuesday	**First Grade** 4:00-7:00 CAPSI **Second Grade** 3:00-6:00 CAPSI	**Kindergarten** 3rd Tues.3:30-6:30 CAPSI
Wednesday		
Thursday		
Friday	**Fourth Grade** 3:00-6:00 3rd Fri. CAPSI LAB	
Saturday		

Pasadena Center

THE PASADENA CENTER FOR IMPROVING ELEMENTARY SCIENCE EDUCATION

The Caltech Precollege Science Initiative and the Pasadena Unified School District proposed to the NSF in April of this year that we create a Center for supporting district-wide science education reform. The goal is to help 14 California urban districts initiate change based on the Pasadena model over a six year period, bringing a new cohort of two or three districts into the program in each of the first five years. The co-principal investigators for the Center grant are Superintendent Vera Vignes and Science Program Coordinator Jennifer Yuré from the Pasadena Unified School District, and Professors Jerry Pine and Jim Bower from the Caltech Precollege Science Initiative.

Funding of 6 million dollars was granted in October. This is the first Center award by the NSF, in a program which will lead to the establishment of several more during coming years. It was the only proposal among many submitted that was approved in the first round. The Centers are intended to augment and extend the overall NSF investment in science education reform, which has amounted to over 500 million dollars in awards to states, cities, and school districts during the past three years.

Some of the details of the Pasadena Center plan are described in the attached Summary adapted from the original NSF proposal. The main thrust of the Center will be to help others eventually emulate the major features of the Pasadena K-6 Elementary Science program:

- Establishment of a district-wide science program for all children in every elementary school, taught by classroom teachers, and integrated with mathematics, language arts, and the remainder of the curriculum.
- A kit-based science curriculum providing materials for in-depth experiments by the children, in four scientific areas during each school year.
- Instruction based on guided inquiry, in which the teacher's role is to facilitate children's hands-on experiments and their construction of scientific knowledge based on experience.
- A commitment to ongoing teacher professional development in content, assessment, and pedagogy, to support effective inquiry teaching and learning.
- Involvement of scientists and engineers in partnership with administrators and teachers in crafting program content and modeling the process of scientific inquiry.

A Center for Teacher Enhancement in Support of District-Wide Reform

A Center is proposed to promote district-wide change to hands-on inquiry science teaching in the elementary grades. The model builds on the experience of the Caltech Precollege Science Initiative (CAPSI) and the Pasadena Unified School District in collaborations with school districts in Pasadena, Maui, and Conejo Valley, California. The main features of the model are the initial creation of a fully transformed pilot school, which embodies total teacher support with materials, ongoing professional development, and frequent collegial interaction with a mentoring resource teacher. Another important feature is that the change effort is supported by collaboration of a school district with practicing scientists and engineers from a university, college, industry, or community.

The proposal is for the center to work during five years with fourteen urban school districts in California, with a population of 30-98% underrepresented minorities. There are 97 such schools, each with more than 5,000 elementary students, in the state. Fifty have more than 50% underrepresented minorities (Pasadena has 12,500 students, 80% Latino and African-American). There will be close coordination with the Statewide Systemic Initiative.

Each year a new cohort of three districts will start (with two the first year). The major roles of the Center will be:

1. To help plan a three year pilot school project with each district.
2. To provide intensive professional development experience for pilot school resource teachers, including special seminars, participation in Pasadena Schools professional development activities, and mentoring over a three year period by a Pasadena resource teacher.
3. To provide technical support in the development of pilot school curricula based on the best existing kit-based units.
4. To provide skilled lead teachers for initial kit training of the pilot school teachers.
5. To organize an annual retreat for personnel from all the districts, to share their knowledge and form a community of learners.
6. To help plan for expansion to other schools of the district during the third year of each pilot school project.
7. To fully fund, by subcontract from the Center, the major components of each pilot school program, including the resource teacher salary and teacher professional development.

The Center staff will include three Pasadena resource teachers who will act as mentors for pilot school resource teachers. Others, from CAPSI and the Pasadena Schools, are people skilled in forming scientist/district partnerships, materials development, science education, scientific research, institute planning, and teacher educa-tion. Nationally known consultants in teaching, assessment, and evaluation will participate in designing and leading the teacher professional development activities.

Center Timetable

Fall 1994

- planning meetings
- request for applications sent to potential participants
- workshop for interested school districts

Winter 1995

- review applications
- conduct site visits
  - visit identified pilot school
  - meet with pilot school coordinator and principal
  - interview district leaders and collaborators
- select first-year participating districts (March 15)

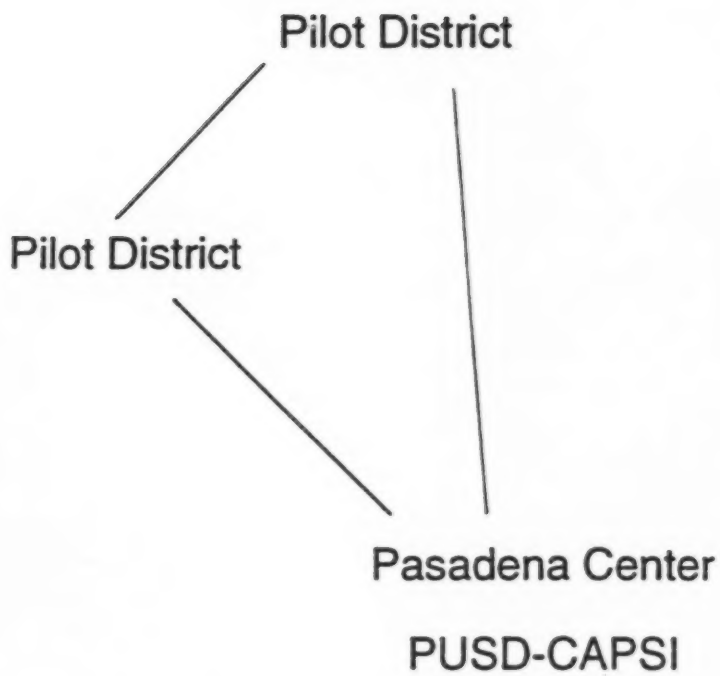
Spring 1995

- finalize plans for first-year professional development activities at pilot schools
- develop subcontract in collaboration with participating districts

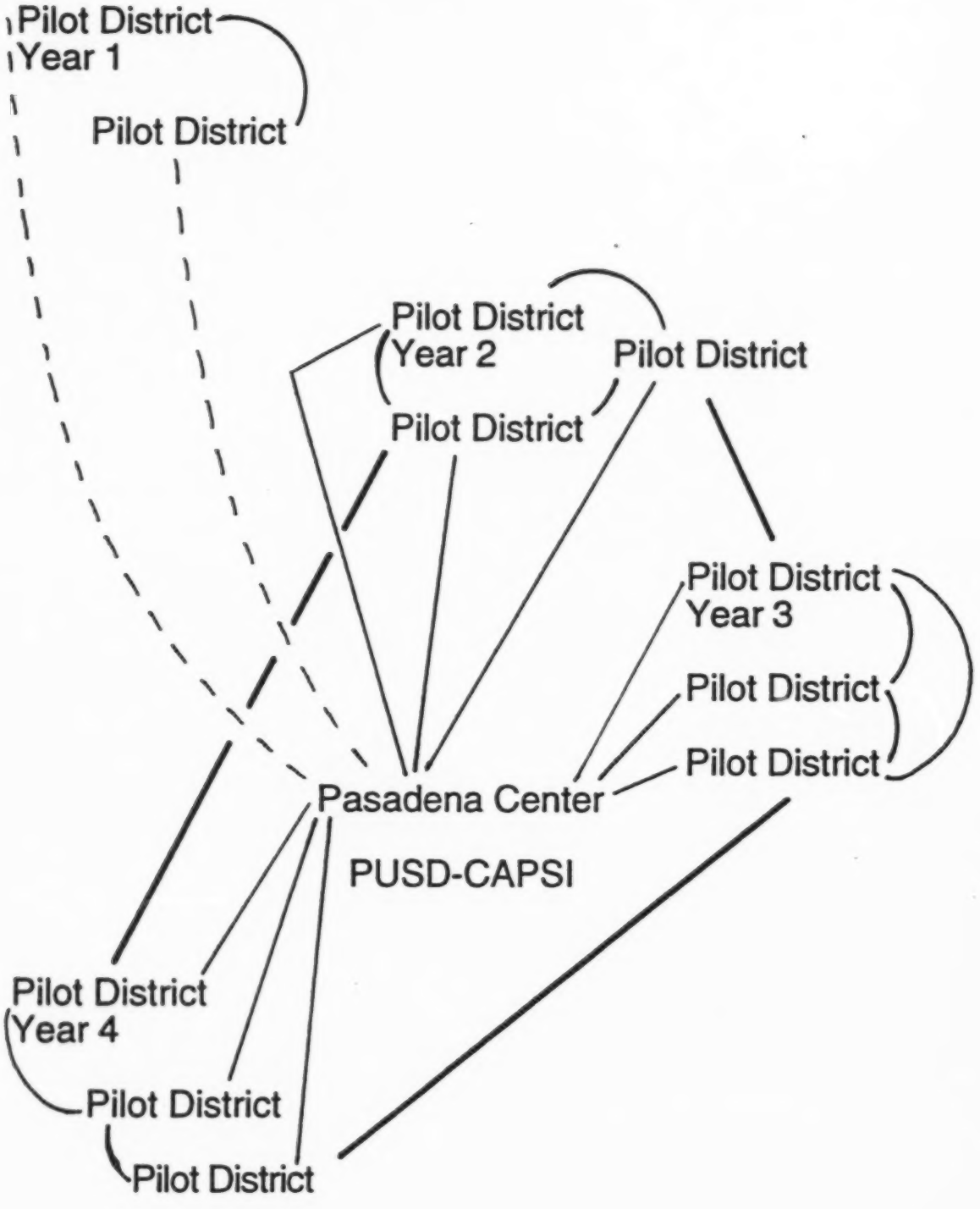
Summer 1995

- begin professional development activities with pilot school coordinators

Center Schematic
(year 1)



Center Schematic
(year 4)



Outline of first-year professional development activities for pilot site coordinators

Summer 1995 (July 10-21 in Pasadena)

A group of approximately 15 people from Pasadena and participating districts will meet daily. The variety of development activities in which they will engage will support ongoing learning about the following elements of their work, and will begin professional relationships within a learning community.

FOCI: Science and Teaching

ELEMENTS:

- Scientific inquiry
- How teachers teach science
- How children learn science
- Curriculum materials
- The resource teacher role

Fall 1995 (one week in October in Pasadena)

FOCI: Teaching a unit, building relationships with teachers, and exploring other units.

ELEMENTS:

- First stage training on the units to be taught
- Mentoring by a PUSD resource teacher
- Involvement of the school principal and a scientist
- Ongoing and in-depth investigation of units available for piloting in the spring

Winter 1996. Two non-consecutive weeks in January and February in Pasadena.

FOCI: The resource teacher role, children's learning

ELEMENTS:

- Shadowing mentor PUSD resource teachers
- Classroom observation of how and what children are learning
- Support for pioneer teachers in the spring

Spring 1996

FOCI: The resource teacher role

ELEMENTS:

- Providing support for pioneer teachers.
- Team-mentoring of pioneer teachers with PUSD resource teacher